ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. 70. CHICAGO, SATURDAY, JANUARY 6, 1917 No. 1

A Review of the Electrical Industry During 1916

THE YEAR 1916 has been an unusual one for the electrical industry as regards commercial activities, all previous high records having been completely eclipsed, and now, at the beginning of the new year, reports from all sources indicate that this prosperity will continue at least during 1917 and, it is hoped, indefinitely.

From the very beginning of the year manufacturers of electrical equipment have had their resources taxed to the limit to produce apparatus and equipment of every description. The immense amount of raw material which forms an essential part of electrical equipment has been needed to a very considerable extent in the manufacture of munitions of war. This contributed to a great scarcity of material early in the year, when some of our manufacturers, notably those making insulated wire and cable, were seriously handicapped through inability to secure a sufficient quantity of these materials to run their plants to their full capacity, to say nothing of catching up with the demand. With improving conditions, so far as availability of material was concerned, there came the inevitable increase in cost. A further hardship upon our manufacturers developed in the scarcity of the two extremes of labor — the highly skilled mechanic on the one hand and the unskilled laborer handling rough work on the other. These conditions brought about many new problems.

The manufacturers of electrical apparatus have been extremely conservative in advancing prices, and the increased cost of material and labor has considerably more than offset any advances in prices which have been made on standard electrical material. However, increase in volume, greater efficiency and economy in mechanical operations, and decreased selling expense, have contributed toward making the year just ended one of great prosperity to the industry in general.

It is estimated that the value of electrical manufactures will be not less than $500,000,000 for the year. This is a great increase over the total for 1916, and an increase of almost $100,000,000 over the next biggest year, which was in 1913, when the value of electrical manufactures approximated $425,000,000. Of the three most conspicuous manufacturers of electrical equipment, it is estimated that the General Electric Company will have a total volume of sales amounting to approximately $150,000,000, and the Westinghouse Electric & Manufacturing Company will total $100,000,000. The Western Electric Company several months ago announced that its orders delivered to customers at the end of the year would total $100,000,000, and that orders booked by December 31 would total $125,000,000.

Electrical exports made new records several months during the year, and it is estimated that the total will be not less than $35,000,000. In 1913, the next biggest year, the value of electrical exports amounted to approximately $28,200,000.

The totals enumerated above do not indicate the actual possibility of absorption of electrical material during the year. Practically every manufacturer of electrical equipment could have increased the volume of sales considerably had material and capacity been available. A large part, in fact, the large part, of the increase in electrical manufactures has been absorbed by users of industrial equipment. The intensification of industry of every description has created a tremendous demand for generator and transformer equipment, for motors, particularly those of fractional horsepower, and the demand for wiring devices has taxed the capacity of practically every producer. It is estimated that in incandescent lamps alone over 5,000,000 new industrial sockets have been created.

The electric light and power companies of the country have increased their gross revenue from approximately $336,000,000 in 1915, to between $425,000,000 and $450,000,000 in 1916. Electric railways will approximate a gross revenue of $700,000,000.

Of the great increase in activities which has come to the industry and to manufacturers in other lines, and of the increased income which has come to the employees in these industries, there has been built up in this country an unexpended increment of unparalleled proportions despite the present high cost of living. Increased cost of structural material, of line-construction equipment, transformer apparatus and incidental material, has deferred much new construction. A large portion of this unexpended increment will be available for this necessary reconstruction and development, and it is expected that for another year at least there is ahead of the electrical industry a season of brisk demand and good prices.

The present discussion of the possibility of the war abroad coming to an early termination may bring about a period of marking time except for the most necessary and imperative things. The termination of the

217782

war will tend to lower prices of raw material and make available for rehabilitation much of the natural resources of the country which are now being annihilated. If, however, the war is to continue, high cost of material and labor will be maintained, but sustained demand for electrical equipment will ensue. Whichever way it falls out, as suggested above, the outlook in the electrical industry is for an unstated period of brisk business, for at least another year.

Looking now to the engineering and scientific developments during the year, in spite of the pressure which has been brought to bear upon the industry because of abnormal business conditions, there has been some definite progress made. Considering central-station activities in the broad sense, there was evident throughout all of 1916 a very great demand for an increase in the supply of electricity for both lighting and power. In a great many instances existing capacity was severely taxed and the utility companies were confronted not only with abnormally high prices for all generating and construction material, but in addition it was practically impossible to secure the equipment needed within any reasonable time. However, it is very gratifying to note that the unusual conditions during 1916 have again evidenced the ability of central generating stations to meet such emergencies, while on the other hand isolated plants, usually without reserve capacity, have suffered greatly and in the end turned to the central stations for help.

There were some advances made in the design and construction of generating equipment, notably in the case of the 60-cycle synchronous converter of large size. The largest prime mover under construction at this time is one of 70,000 kilowatts capacity, which establishes a new record.

In electric lighting and illuminating engineering the most notable advances have been in the direction of a greater utilization of the gas-filled lamps and a development in lighting units looking to the production of substantially artificial daylight. A marked increase in the utilization of flood-lighting equipment is also one of the significant developments of the year.

The past year has been a remarkably quiet one in the electric railway field, largely because conditions in the money market have been such that it has been difficult to find capital for improvements and replacements, to say nothing of extensions. In addition, unprecedented prices for all kinds of supplies and equipment have greatly retarded needed extensions. Electrification of steam railroads has, however, been given a great impetus during the year largely because of the very successful operation of the electrified section of the Chicago, Milwaukee & St. Paul Railroad, and it is of interest to note that the New York Central Railroad has arrived at a decision to electrify its freight line in New York City.

The most notable event in the field of electric vehicles was the consolidation of the Electric Vehicle Association of America with the National Electric Light Association. Electric vehicle interests thus have gained the active co-operation and support of a national organization of approximately 15,000 members, all of whom are more or less interested in this field. Several interesting campaigns were inaugurated during the year, because of this consolidation, looking to the sale of at least one vehicle to every central-station company. This laudable effort will be vigorously prosecuted during 1917, and when the result desired is accomplished electric transportation will have received great impetus throughout the entire country.

Electrical dealers and contractors have enjoyed a very prosperous year, although it has been somewhat along specialized lines. One of the pleasing developments has been the greater co-operation between central stations and contractors, particularly with regard to house wiring and merchandising of appliances. Due to pressure of business there has been little if any development looking toward a less expensive system of wiring for residences, but it is an encouraging sign of the times that the national convention of contractors held last summer strongly endorsed a movement to arrive at some less expensive method that would have the same factor of safety as present systems.

In the field of electrochemistry and electric furnaces the most significant development has been in the large increase in the use of electric steel furnaces and in the application of industrial electric heating. Large automobile factories and munition factories have turned to industrial electric heating because it greatly facilitated production, which was the all-important item during 1916. There were also several experimental electrochemical plants constructed during the year, and undoubtedly American manufacturers will be able to produce in this country by the electrochemical process products which were heretofore only secured from Europe.

In the field of telephony and telegraphy there has been further progress during the year in the refinement of application of the de Forest audion, and also considerable progress in the dissemination of knowledge concerning inductive-interference phenomena, and the development of a more sympathetic understanding upon the part of power companies and telephone companies of each other's problems.

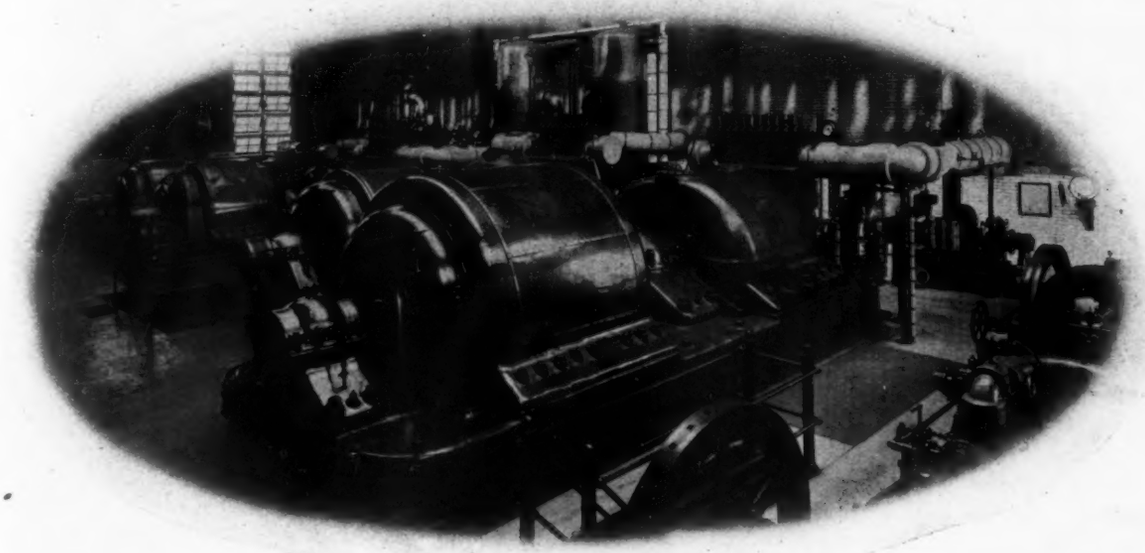
The greatest development in wireless telegraphy, which may perhaps also be characterized as one of the greatest electrical developments of the year, was the establishment of wireless communication between San Francisco, Cal., and Tokyo, Japan. The great activity in ocean shipping, together with naval warfare, has given great stimulus to wireless telegraphy, and during 1916 there were made, of necessity, a great many refinements and improvements.

In the following pages we present in condensed form a review of each branch of the industry during 1916, prepared in each case by an authority of international reputation. A careful perusal of these reviews will disclose many interesting facts concerning the past year, which should be of interest to everyone engaged in the electrical industry.

YAHOO!

THE YEAR IN THE ELECTRICAL INDUSTRY

Central-Station Activities—Electric Lighting and Illuminating Engineering—Electric Traction—Electric Vehicles—Electrical Contracting—Electrochemistry and Electric Furnaces—Hydroelectric Development—Telephony and Telegraphy—Wireless Telegraphy and Telephony



Central-Station Activities

By PETER JUNKERSFELD

President, Association of Edison Illuminating Companies

THE central-station industry has passed through three very unusual years. During 1914 and 1915 forced economies resulted in private-plant owners looking more closely into their operating costs and thus a greater number purchased electric power from central stations. In 1916 the very marked quickening of all industries created a demand for immediate increase in the supply of electric power. Manufacturers who were already purchasing power from central stations were able to secure additional power as quickly as they could utilize it, but those who were not purchasing this power were unable to secure early delivery of the necessary generating machinery and naturally looked to the central stations for electric power.

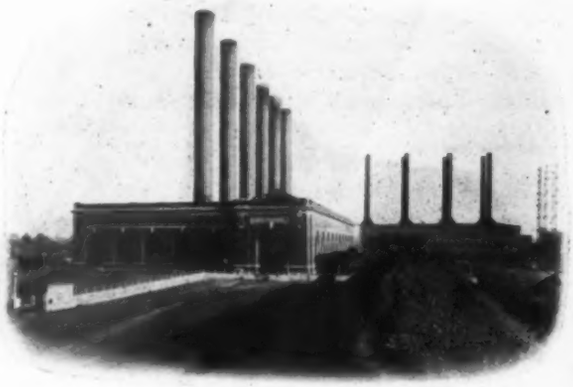
The scarcity of raw material affected also the delivery of equipment for central stations, but such central stations already had considerable capacity at hand in the form of previous reserve capacity and required comparatively little apparatus to supply the additional power service. In addition the increased business of the manufacturer and provisions for greater safety and efficiency resulted in more electric light in the factory. The general prosperity of the country meant better merchandising methods and thus more liberal use of electric light and power in a larger number of commercial establishments. Better living meant the use of electric light and of more electrical appliances in a larger number of homes.

During the year there was a still further increase in the size of generating units, but only to a very limited extent. The largest prime mover under construction at this time is one of 70,000 kilowatts capacity, which, however, consists of three separate parts; one for high-pressure steam and two for low-pressure from the exhaust of the first. Each of these three units operate at 1500 revolutions per minute. The largest single generator ordered during the year is rated at 45,000 kilowatts, 12,000 volts and operated at 1200 revolutions per minute.

The manufacturers of steam turbines have been so busy during the year that development work was difficult, if not impossible in most cases. The large increase in steam temperature to be employed which was much discussed a year or more ago, has not materialized. Few if any steam boilers are being installed for pressures higher than 350 pounds with superheat of 225 degrees Fahrenheit. The greatly increased cost of even well-standardized equipment, and the practical impossibility of manufacturers at this time to undertake new developments, has limited the size of new generating units as well as their efficiency.

The very large increase in new power business resulted

Reviews of the Year in the Electrical Industry



in the further extension of transmission lines to towns and villages and has resulted in a considerable increase in the number of outdoor substations. The proven reliability of well designed outdoor substations and their comparatively low cost seems to indicate their further adoption for certain classes of installation even under severe climatic conditions.

The long discussed 60-cycle synchromous converter of large size for railway purposes has arrived. Units of this type of 3000 kilowatts capacity are becoming common for supplying 600-volt power to railways. Larger units of 5800 kilowatts, 600 volts, are in service for electrolytic work. The extraordinary high price of copper at this time has undoubtedly had some effect, and will probably have greater effect on the installations of transmission lines.

This necessitates making the greatest possible use of such lines and in turn requires better attention to the matter of relays and the general problem of operating such lines. Of interest in this connection is the subject of grounded neutral and of ground wires on transmission lines, both of which received much attention ten or twelve years ago but have again become matters of very great interest.

Electric railroad companies have continued to purchase a larger and larger portion of their power requirements from central-station companies. The economies resulting from specialization and massed power production in a single territory are being better understood by all parties interested.

The electrification of steam railroads is attracting renewed attention. The successful operation of the St. Paul electrification in Montana and the Pennsylvania Railroad terminal in Philadelphia, both supplied with central-station power, is especially noteworthy. In Montana the electric locomotive has proven its independence of the terrors of winter which have caused so much trouble in slowing down and freezing up its steam antecedents. In Philadelphia a distinct advance was made in the satisfactory demonstration of another method (the phase converter), by which very heavy and intermittent single-phase steam-railway requirements could be supplied from three-phase generators of the central-station company. It is of special interest to note that the Illinois Central has recently offered to electrify its terminal and surburban service within the next five years.

There has been an unusual expansion in the electrochemical and electrometallurgical industries largely because of the increased domestic demand from industries which can no longer import materials from abroad. This has resulted in the sale of central-station power in a very large part to such industries in different parts of the country. In metallurgy the electrical processes are gaining ground in every industry where the prevention of waste or the production of an article of exceptional quality have become of prime importance. As more careful conservation of our resources becomes necessary and as our demands for quality become more exacting electrical processes steadily gain ground.

The number of electric steel furnaces in the United States has practically doubled during the year, there being about 140 in operation at the present time. The present output of such furnaces probably exceeds 1,000,000 tons per year and requires in the neighborhood of 150,000 horsepower. The United States now has more steel furnaces in operation than any other country and the number is constantly increasing.

Electric lighting has excited a marked renewal of interest. It seems definitely demonstrated that high-efficiency lamps react to increase rather than decrease the consumption of energy. The advantages of more light once seen in the industries, in commerce and in homes, the demand is for yet more light. In practically all localities, large or small, lighting load has shown very healthy growth despite the increasing replacement of the gem and carbon lamps with the newer tungsten lamps and extensive programs for the wider application of cheap light for economic advance have been adopted by several of the larger central stations. Flood lighting is a new field made possible by the development of the high-efficiency incandescent lamp and central-station revenues have been substantially increased during the year by reason of this business.

The large sale of household electrical appliances during the past year has probably done more than anything else to popularize electric service and promises to be a much more important factor in the future. Electric cooking has made substantial progress and is no longer confined to localities served by hydroelectric plants.

The forms of rates for all purposes other than residence service are becoming more and more standardized on the demand system of charging. While the detailed application of this system varies greatly among the different companies due perhaps largely to the difficulties in securing sufficiently quick delivery of the necessary instruments, the correctness and fairness of the underlying principle of the demand system is now almost universally recognized.

The forms of rates for residence purposes is not nearly so well standardized and there is much room for improvement. Such improvements, however, are extremely difficult of attainment. Very few, if any, central-station companies have therefore been able to do more than make slight modifications in their form of residential rate. The desirability and ultimate necessity of a greatly simplified and much less costly scheme of residential rate is becoming more apparent every month. The large amount of additional residential business that it is possible to secure in most communities and for the standpoint of public relations, the desirability of serving such additional residential business is also perhaps more appreciated than heretofore.

It is of more than passing interest to note that in face of the greatly increased prices of all commodities and of all equipment and supplies entering into the manufacture of electrical energy the price of energy is steadily decreasing and a number of companies have voluntarily reduced their rates during the past year.

Electric Lighting and Illuminating Engineering

By DR. LOUIS BELL
Consulting Engineer

THE past year has been devoid of anything of a highly sensational character, but yet has shown rapid progress in some interesting and important directions. The most striking of these is along the line of gas-filled lamps, which are now available in sizes, in the beginning thought impracticable, but now promising great usefulness. Just where the limit is at which it will cease to pay to use the gas-filled bulb, on account of relatively increasing convection losses, it is too early yet to predict.

A thorough analysis of the operations of the year would show remarkable progress not only in the substitution of the old for the new type in incandescent street lighting, but in the rapid and widespread replacement of the less efficient types of arc lamp by large incandescents. As the gas-filled lamp has already nearly driven the commercial carbon arc off the earth, so it is swiftly proceeding to chase the street-lighting carbon arc into oblivion. What will be the fate of the powerful and efficient flame and luminous arcs is another story. So far they are tending to hold their own in virtue of relatively small consumption of energy and of a quality of light with which the gas-filled lamp cannot as yet compete. Whether a white or a yellowish light is more desirable for public illumination is a question chiefly of mass psychology.

This very brightness as shown in the gas-filled incandescents is a source of both good and evil. Psychologically it undoubtedly conveys a pleasing impression. Physiologically it is rather a source of worry. It compels almost as much care in shielding the illuminant as in the case of the old-fashioned arc, and while this is in general a good thing it is sometimes inconvenient. The result will inevitably be the increase of semi-indirect and indirect lighting, on the whole to the benefit of the art. But in both caution is required lest the area which serves as a source of light should itself remain still too intense. This is very noticeable in some inclosed or partly inclosed fixtures in which the intensity of the transmitted light is far too high compared with the surroundings for comfortable illumination.

Perhaps the most important tendency which has been displayed during recent months, however, is a freer employment of the highly efficient lamps now at our command to obtain an approximation, at least, to a daylight quality of illumination. The Cleveland Art Museum is a very beautiful and striking example of the successful application of such lighting to a purpose for which

it is peculiarly well adapted. Many schemes for producing substantially artificial daylight have been put into use, taking the form for the most part of color screens designed to balance the light values by absorption of a certain amount of the red and yellow. The plan of thus whitening light is a very old one, running back nearly 40 years to the days when light blue lamp chimneys for kerosene lamps were widely exploited for the very purpose now in hand. Pretty good daylight can now be obtained without a loss of efficiency at all unreasonable, considering the very low specific consumption of the sources. When we consider that electric light can now be obtained for something like 10 per cent of the cost per candle-hour charged a score of years ago, it is easy to see that some sacrifice of efficiency can well be afforded in order to obtain a desirable result, whether in the way of daylight or of decorative effects. How far the uses of artificial daylight are going to extend it is too early yet to prophesy. It has already shown great usefulness in window and display lighting of various sorts. It seems highly probable, too, that it may still further win out in more utilitarian fields. The writer is inclined to think that if in a shop the night shift were given ample illumination of substantially the same quality found in daylight working its output would improve in quantity and quality. The probability seems at least sufficient to justify trying out the plan on the considerable scale which would be required to obtain definite information.

In domestic lighting the tendency is distinctly away from daylight values, again for psychological reasons. Perhaps one associates daylight with toil and artificial light with pleasure or rest. At all events it is a fact that the familiar tints in the artificial light to which mankind is already used seem in most instances pleasanter than the somewhat bluish white of daylight. There has therefore been a movement toward toning down for domestic purposes the whiteness of the most recent illuminants, and giving them somewhat of the color value of the older flame or incandescent lamps. Here again the great efficiency now attainable comes into play advantageously for one can get a soft and mellow light from a metallic-filament lamp much more efficiently than he could obtain it by running down the efficiency of the filament itself. This is a matter of the judicious choice of the screen, or colored bulb and while such modified lamps have not yet come into wide use the experiments with them have gone far enough to show that the result can be reached, and will be for some purposes very gratifying in its nature. One might go further than this and point out that, with the present sources available, modification of the color of the light for various decorative purposes by screens and shades becomes at once thoroughly feasible instead of being a thing only to be obtained by a loss of light which in the earlier days of the art must have been regarded as serious. The long and short of the matter is that we now have cheap and plentiful light with which we can do whatever seems to be necessary in the way of utility or art. Light is about the only thing which has fallen in cost through a period of unexampled rise in the cost of nearly everything else that can be reckoned as a necessity.

Electric Traction

By PROF. A. M. BUCK
University of Illinois

THE past year has been a remarkably quiet one in the electric-railway field. In general the situation has remained practically as at the close of 1915, and operating companies have felt reluctant to make any great changes from the methods in use at that time.

Conditions in the money market have been such that it has been difficult to find capital for improvements and replacements, to say nothing of extensions. This fact, coupled with the unprecedented prices for all kinds of supplies and equipment, is at the bottom of the situation as it exists today. Most of the electric railways are, therefore, merely marking time until there is a return to something like normal conditions.

In the meanwhile, in order to keep the properties operating, many roads are remodeling their old and out-of-date equipment to meet modern demands as well as may be. Practically all of the larger systems have numerous obsolete cars which have been retired from active service. It is now being found advantageous to revamp this equipment in order to provide for the normal growth of traffic.

Those roads which have been fortunate enough to have cars on order have given much thought to the design so as to get the most out of the investment. The revolution in car design which started some four years ago is resulting in the construction of city cars of the low-floor, center-door type, arranged for maximum facility in loading and unloading.

Economic features have spelt the death-knell of the jitney bus. The sharp rise in the price of gasoline and tires, in conjunction with the increased value of second-hand automobiles, have aided in convincing the jitney operators that this method of local transportation is in the end a losing venture for them as well as for the community. State and local regulating bodies have also taken a hand when they have seen that the credit of the electric railways is being impaired by the diversion of traffic.

As predicted in these columns a year ago, the jitney movement has had a good effect on the electric-railway managers in that it has clearly shown that the public demands a better class of service than has been given in many cases. This has led to a revision of schedules, a general attempt to give better service in every way, and the rapid rise of the light-weight one-man car. This latter development is probably the outstanding feature of the year in the city traction field. The new designs of one-man cars are constructed with large seating capacity for their size and weight, and are so arranged as to provide a maximum of service at the lowest possible cost.

A remarkable situation, extending through the latter part of the year has been the unrest of the labor element. Employees have seen their brothers in the manufacturing field receive large increases in wages, and, naturally enough, have been trying to obtain similar results for themselves. On some of the largest systems exorbitant wage increases have been demanded, the men failing to take into account their comparative permanence of employment as compared with the munition business and allied manufacturing. Since the electric railways have recently been operating on very narrow margins of profit, the great increase in the cost of everything entering into transportation has made it necessary to refuse or to discount these demands, thus creating an extremely unfortunate situation.

The coal situation is also becoming acute with some of the companies in the Middle West. It is now difficult to obtain coal in quantity at any price, and the roads are forced to economize, even to curtailing of service.

The reign of extremely high prices has prevented a full realization of the prosperity which was noted at the beginning of last year. As a result the increases in gross revenue which have followed the general business revival have been more than absorbed by the higher operating costs. Prosperity has not extended to the far-western roads, where the income will probably show an actual decrease for the year.

In all possible cases the railways are applying to the various regulating bodies for relief. The action has generally taken the form of requests for fare increases. While some of these have been refused, there appears to be a markd tendency to lend assistance in relieving the roads of the burdens imposed on them by municipalities. The case which has attracted the most attention is that of the Bay State Street Railway, operating about 950 miles of track in the vicinity of Boston. A proposed increase of fare from a 5-cent to a 6-cent unit was refused, but the Massachusetts Commission indicated that it would be willing to relieve the company of some of its municipal burdens, such as paving maintenance and service requirements.

Notable events during the year were the decision of the New York Central Railroad to electrify its freight line in New York City, the opening of a street-railway passenger terminal in Newark, and the completion of the 440-mile electrification of the Chicago, Milwaukee & St. Paul from Harlowton, Mont., to Avery, Idaho. The purchase of a 70,000-kilowatt turbogenerator by the Interborough Rapid Transit Company and the passing of the last horse car from the streets of New York are also noteworthy.

Relief is at last in sight for the residents of Chicago. The transit commission appointed by that city has recommended a comprehensive system of subway and elevated lines to be operated in conjunction with the existing rapid-transit roads, and also a complete unification of all the traction interests in the city. In addition, the Illinois Central Railroad has announced that it stands ready to electrify its suburban service as soon as an agreement with the city can be worked out.

The only other large projects which are reported as having received serious consideration are the proposed electrifications of the Pennsylvania Railroad between Altoona and Pittsburgh, and between New York and Philadelphia. It is quite probable, however, that these improvements will be deferred until there is a more normal tone to the financial and manufacturing situation.

Electric Vehicles

By E. S. MANSFIELD
Chairman, Electric Vehicle Section, N. E. L. A.

THE history of electric-vehicle development during the past year has been so closely identified with the activities of the Electric Vehicle Associatoin of America and the Electric Vehicle Section of the N. E. L. A. that it will be necessary to outline briefly the accomplishments of these organizations in order to describe adequately the growth of the electric vehicle itself.

The Electric Vehicle Association of America was incorporated in 1910 by the central stations and electric-vehicle manufacturing interests for the purpose of stimulating the progress of the electric, which even at that time gave promise of a healthy career. The Association had a remarkable growth for six years and accomplished much along educational, advertising, publicity and constructive development lines during what might be termed the period of pioneering until the electric vehicle arrived at a state of commercial success.

In March of last year the Vehicle Association became amalgamated with the National Electric Light Association and has continued its activities as the electric-vehicle section of the national body. This action was taken because the Vehicle Association had practically accomplished the purpose for which it was organized and the national association had an organization which could carry on the work in a larger and broader way without the duplication heretofore existing. The wisdom of this union at once became evident, as the electric-vehicle interest became indentified with a body having approximately 15,000 members, who could be reached more easily and who at once became interested in the success of the new section.

During one of the sessions at the last convention of the Electric Vehicle Section, H. A. Wagner, the newly elected president of the National Association, delivered an address on the topic of co-operation and urged the member companies to offer substantial support to the electric vehicle and supplemented his remarks with the promise of an order for 25 electrics during the year, the order for which was placed shortly after. Following the lead of the president, an active co-operative selling campaign was inaugurated and a series of letters addressed to the active members asking them to establish electric-vehicle departments in their organizations and also agree to purchase electrics during the year for their own use and for resale to customers. The manufacturers at once offered to members special inducements in connection with the campaign, and the results already obtained promise the success of this project.

With regard to the development of the vehicle itself and its increased use and popularity, as there have been no spectacular happenings to act as landmarks, a general description of the various marks of progress will be the better way of handling the subject, which will be done by focusing our attention on each class of vehicle separately. The passenger electric, which has been eagerly sought by those who appreciate luxury, safety, ease of handling, simplicity and lack of care, has enjoyed a healthy growth, and statistics indicate a substantial gain in the sale of electric automobiles, one manufacturer having shown an increase of 281 per cent over the same period in 1915. As the passenger electric is used for "human" transportation, its progress must be along the lines of increased numbers and added classes of users, and in these respects the results have been very gratifying. During the year many new and luxurious models have been displayed and in some cases the prices have been reduced, and present indications promise new models and more attractive terms for the coming year.

The commercial electric, which may be said to have a somewhat later development, has shown remarkable progress. The electric truck is now being used in over 100 different lines of business, principal among which may be included the following: express companies, department stores, breweries, bakeries, central stations, laundries, jewelers, warehouses, etc., some of which machines have been in use more than 10 years.

The "electric" in municipal use has had a remarkable increase during the past year, both in this country and abroad. One of the most spectacular uses to which it has been put is in the fire-department service, and the advantages of electrically propelled apparatus are being more and more appreciated.

One of the recent examples of wholesale conversion took place in Camden, N. J., where the entire fire equipment has been modernized; as a result of the good showing of that city, Paterson, N. J., has placed an order for 11 pieces of electric fire apparatus, together with such charging apparatus as will be required to recharge the batteries. Other cities using electric fire apparatus are Philadelphia, Baltimore, Brooklyn, Springfield, Mass., Grand Rapids, Mich., and Akron, Ohio.

The electric for street sweeping and cleaning and for the collection of refuse is being used successfully by municipalities in this country, also in France, Germany and England. Electric ambulances which have proven themselves to be ideal for the transportatoin of sick and injured are being used in a number of the hospitals.

As a result of the war the electric in England has increased about 400 per cent in two years, among the larger fleets being that of Messrs. Harrods, Ltd., a department store in London, employing a fleet of 60 electric trucks, and the Midland Railway Company, which has 73 electric trucks in use or on order. Large exportations have also been made to South America, China and Norway.

The electric taxicab which has met with such remarkable success in Detroit gives promise of an extensive development, installations having already been arranged for in Chicago and St. Louis, and investigations are being made in other of the principal cities of the United States.

There are a number of developments of the electric vehicle still in the uncompleted state which will add materially to the popularity of the electric, so that in the year to come we may confidently look for a continued healthy growth of the vehicle which depends for its power on the all dominating force of the times.

Electrical Contracting

By E. H. FREEMAN
Past President, National Electrical Contractors' Association

CONDITIONS in the electrical contracting field have, along with the other branches of the electrical industry, been somewhat unusual during the past year, although nothing of a sensational character can be recorded. Perhaps, as a whole, the industry may be said to have passed through one of its most successful years, although there are a great many individual exceptions. There is, however, a universal and well founded belief that the prospects for 1917 are without doubt the most promising in the history of the business and this outlook is in nowise contingent either upon the continuance or conclusion of the great European war.

The early part of 1916 was not very encouraging to electrical contractors. There were, of course, frequent opportunities to submit bids on new work, but because of the abnormal market and labor conditions seldom, if ever, was it possible to make a profit. Not infrequently the margin of profit was entirely absorbed by the advance in the cost of material between the time of first submitting a bid and ultimately securing the order. Eventually contractors came to a realization of the seriousness of conditions and the co-operation of the manufacturers was obtained, so that it was possible to submit bids based on prices at which the material could actually be secured.

Considered as a whole, the work of 1916 was very largely in the nature of extensions to existing equipment, rehabilitations and improvements, rather than important new work. This was due, of course, to the abnormal business conditions which obtained, making it imperative for factories and industrial establishments generally to enlarge and modernize their equipments in order to meet the extraordinary demands imposed upon them. Lack of time and ridiculously high costs for all materials resulted in a relatively small number of new buildings being constructed.

A very gratifying phase of the situation is that there has developed during the year need for many new buildings of all kinds to relieve the present congestion. The money for this work is available and undoubtedly much of it will be done during 1917, resulting, of course, in additional business for electrical contractors.

One of the significant features of the year just closed is the large number of expensive residences built, entailing extensive electrical equipments. This activity was naturally due to the prosperous conditions throughout the country and may be expected to continue during this year. There was also the usual activity in small residence and apartment-building work with unusual activity in those localities where industrial progress was greatest.

In a review of the year prominent mention must be made of the annual convention of the National Electrical Contractors' Association, which was held in New York July 17 to 22. No greater example of co-operation can be presented by any other industry. The discussion of the subject of concentric wiring was of extreme importance, as it indicated that electrical contractors as a class, while not in favor of concentric wiring, are strongly in favor of some form of wiring that will result in less expensive construction than that at present used. The work of the Association during the past year has also been very commendable and undoubtedly been of very great value to its members.

Distinct progress must be reported in regard to co-operation between central-station companies and electrical contractors. It is becoming the policy of central stations, almost universally, to finance, on a two-year installment basis, house-wiring contracts that are secured by contractors. To a greater extent than ever before the public utilities are appreciating the importance of the good will and co-operation of the dealer and contractor and are withdrawing entirely from the construction and merchandising fields.

It is with a great deal of satisfaction that I can state that great progress was made during the past year in applying improved methods to the business of electrical contracting. To a greater extent than ever before contractors have realized that a suitable bookkeeping and cost system is a vital essential in their business and that they must know their overhead expense before they can intelligently submit a bid on a job. In the merchandising field distinct progress has also been made and there are now relatively few electrical dealers who do not realize that modern methods must be employed if success is to be achieved.

A somewhat new field that has experienced considerable development during 1916 is that of flood lighting. This form of illumination has become exceptionally popular for all classes of civic and other celebrations and also for various forms of permanent lighting. Needless to say, considerable business for electrical contractors has resulted from this activity, which is likely to continue and probably increase.

Electrochemistry and Electric Furnaces

By PROF. M. DE KAY THOMPSON
Massachusetts Institute of Technology

THE progress in electrochemistry and electrothermics during 1916 has been rather an increase in the production of established industries than in the starting of new industries. This increase in production has resulted in a power famine at Niagara Falls which has been discussed at length in the technical papers of the country.

During the past year the electrolytic refining of tin has been added to the list of American electrochemical industries. This is carried out in the plant of the American Smelting & Refining Company, at Perth Amboy, N. J., which is intended to handle eventually 1,200 tons of tin ore per month. The ore, which comes from Bolivia, was formerly sent to England or Germany for smelting and refining, and the resulting tin was then shipped to this country. The American Smelting & Refining Company has at present contracted for 750 tons of Bolivia 60-per-cent tin concentrates per month, so that the plant is not yet working at full capacity. The tin is smelted in reverberatory furnaces and is then refined electrolytically. Tin 99.95 per cent pure has been produced in the experimental plant, and the purity of that from the larger plant is probably about the same.

Due to the high price of zinc, a number of plants for the electrolytic production of zinc are either under construction or have been recently completed. In these plants the object is to get metallic zinc from the ore. For this purpose the zinc ore is leached, giving a zinc salt solution, and this is electrolyzed with unattackable anodes, producing zinc at the cathode.

An experimental plant was started at Bully Hill, California, in March, 1915. The electrolyte was zinc sulfate. Sulfuric acid is regenerated at the anode. The stationary cathodes were 36 inches long by 24 inches wide. Rotating cathodes were also used, at 1.5 to 2 rotations per minute. These were 4 feet in diameter.

In the early part of 1916 a zinc plant was under construction by the Anaconda Copper Mining Company at Great Falls, Mont. This plant is to take the concentrates from the concentrator at Anaconda, which are roasted and then leached by sulfuric acid. The impurities are precipitated by limestone and zinc dust. The zinc is then deposited electrolytically on copper-aluminum plates, and is stripped off every four hours, and melted. The anodes are pure lead. The current density at the cathode is 20 to 30 amperes per square foot. Each cell has 3.4 to 3.8 volts applied to it. The tanks are five feet long, three feet wide, and three feet deep. They are placed end to end, six in a group, and the solution circulated by gravity from tank to tank. Each tank contains 28 lead anodes and 27 cathodes. Each cathode contains 14 pounds of aluminum and 16 pounds of copper. The zinc is said

to be 99.9 per cent pure. The plant is to produce 100 tons of zinc per day.

The Consolidated Mining & Smelting Company, of Canada, in 1915 was constructing a plant capable of producing 25 to 35 tons of electrolytic zinc daily, and this was placed in operation in the early part of 1916.

In August a plant for the electrolytic production of zinc was under construction at Park City, Utah, for the Judge Mining & Smelting Company. This plant is intended to handle 30 tons of high-grade zinc concentrates per day and to turn out 15 tons of electrolytic zinc. Revolving aluminum cathodes are to be used.

Iron has been refined electrolytically abroad for some time, but not in this country on a large scale until 1916. The method is due to Burgess and Watts. The electrolyte consists of iron sulfate and iron chloride and ammonium sulfate. A small amount of ammonium oxalate is added to improve the deposit. The anodes are basic open-hearth steel. The cathodes become 10 to 13 millimeters thick before removal. It is estimated that the cost of electrolytic refining would be approximately $10 a ton.

The electrolytic production of hydrogen and oxygen has been established in this country for a number of years, but a new electrolytic cell has been brought out during the past year by the International Oxygen Company of New York, which is a great improvement on the one previously used by this company. This new cell evidently requires much less floor space and much less solution for a given production of hydrogen and oxygen.

The new cell has bipolar electrodes, separated by specially prepared asbestos diaphragms with rubber rims, which rest in recessed grooves on the face of the electrode and prevent leakage. The electrodes and diaphragms are clamped together, and have the general appearance of a filter press.

The anode side of the electrode is heavily nickel-plated. This protects the iron from electrolytic corrosion and also lowers the voltage required for decomposing water, as nickel has the lowest overvoltage for oxygen of any metal. The cathode side is commercially pure iron. The solution is potassium or sodium hydrate.

The water is replaced automatically as it is decomposed and the water intakes for anode and cathode compartments are independent.

The gases are led out through cored channels at the tops of the electrodes, the anode sides all delivering into one channel, the cathode sides into the other.

The uses for hydrogen and oxygen have been developing rapidly during recent years. The use of hydrogen has increased to a very great extent in the hardening of oils by the hydrogenation process. Hydrogen is also obtained for this purpose as a byproduct from the electrolysis of sodium chloride.

The war has given a great impetus to the use of electric steel furnaces. The total number of such furnaces in operation in the world has increased from about 150 in 1913 to over 300 in 1916.

The growing importance of electric furnaces is shown from the fact that several prominent central stations have formed research departments to study industrial electric heating problems involving furnaces.

Hydroelectric Development

By LAMAR LYNDON
Consulting Engineer

THE year 1916 shows a record of but meager activity and performance in the development of water powers. No plants of importance have been constructed and put into operation, and the manufacturers of machinery and apparatus for hydroelectric plants have depended on filling their shops with ammunition orders or other alien work to keep running.

Several causes are assignable for the practical cessation of a formerly active branch of the engineering art. The first and principal one is the high price of copper and aluminum. The cost of transmission conductors is now almost double the normal value and when the existing chaotic conditions, which have followed the European war, have returned to the reasonable and usual state, the prices will become, approximately, the same as they were three or four years ago. Hence, any investment made during the past two years in transmission lines may be expected to diminish in value 35 to 40 per cent, thus permanently wiping out a considerable portion of the capital.

Another factor which has contributed to restrain any activity in water-power development is the indefinite and nebulous policy of the United States Government regarding riparian rights, and the hazy conditions under which water-power developments are permitted. Unfortunately, certain views seem to prevail among the law-making bodies in Washington which are based on personal ideas and newspaper statements rather than the facts as they exist and which could be properly assembled and set forth only by an expert body of engineers, qualified by training and experience to furnish reliable data.

The present tendencies of designers seem to be towards the use of solid dams of cyclopean masonry, though the steel-reinforced-concrete type continues to grow in favor. The multiple-arch type, though economical and especially suited to certain localities and conditions, is not much used.

Forcing grout into cavities and fissures under air pressure to solidify the foundation of a dam has been found economical and effective and particularly applicable to limestone and sandstone stream beds. The use of pressure-moved grout has now become common practice, except when the river bed is in granite.

The practice of placing some form of movable gate, or barrier, on the crest of a dam is gradually growing. The ability to increase both the head and the quantity of stored water, and thereby the available power during periods of minimum stream flow, and at the same time keep the maximum height of the flood waters within the limits fixed by the elevation of the crest of the dam, possesses such obvious commercial and operating advantages that it is difficult to understand why crest gates are not more widely used.

Single-runner, vertical turbines with "umbrella"-type generators have become practically the standard form of generating equipment. While this is the most suitable and economical kind of apparatus for the majority of situations, the blind adoption of single-runner vertical turbines, regardless of the size of the units or of the operating head, will necessarily lead to improper and uneconomical equipment in many instances.

Exciters are driven by water wheels in large plants where the exciter capacity required is 250 kilowatts or more. In smaller plants, it is becoming more usual to install motor-driven exciters, there being two of these machines, each sufficiently large to supply exciting current to all the generators. A third exciter is also provided and arranged to be belt-driven from one of the water-wheel or governor shafts, its capacity being just sufficient to excite one generator. This small exciter is used only for starting the plant when it is first put into commission or in case of any accident which causes a shutdown of the motor-driven exciters. When motor-driven exciters are used, automatic voltage regulators are provided. Variations in generator speed cause corresponding variations in the speed of the exciter motors, so that the excitation of the generators changes with the speed variations. This results in such wide fluctuations of generator voltage that an automatic voltage regulator is necessary.

The present tendency seems to favor less complicated switchboards and switching systems than in former years. Experience has demonstrated that if sufficient switching equipment is used to perform the usual routine service, nothing is gained by providing for unusual and sporadic conditions with an accompanying complication of switchgear and of daily operation.

The step-up transformers, lightning arresters, choke coils and high-tension switches are located out-of-doors, so that the size and cost of the power house is considerably reduced.

Switching is done on the low-tension side of the circuit, the step-up transformers and the transmission line being treated as a single unit instead of considering the generator and transformer as a unit, and switching on the high-tension side, as was former practice.

For the protection of transmission lines against external electrical disturbances the overhead ground wire is still in favor and its use is standard practice. Arcing horns are also used to a considerable extent, particularly on suspension insulators, but in nearly every instance, they are simply auxiliary to the ground wire and not a substitute for it.

Altogether, the general practice remains substantially the same as it was three years ago or more, there being practically no advance made in the art since 1913.

Telephony and Telegraphy

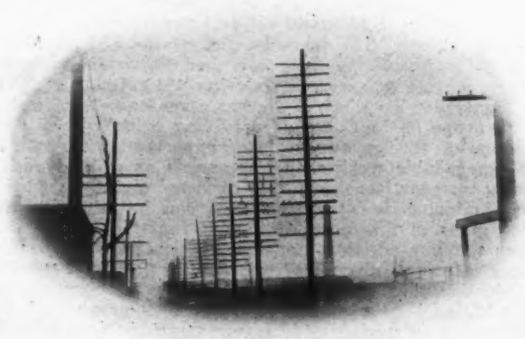
By FRANK F. FOWLE
Consulting Engineer

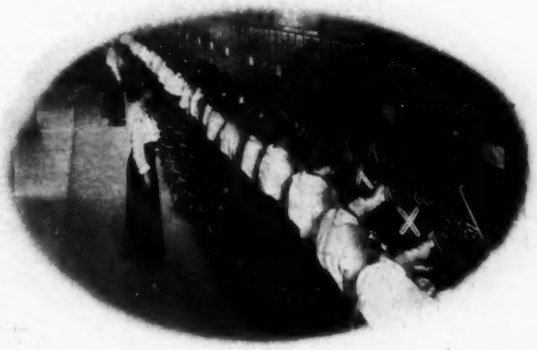
TECHNICAL progress in the telephone art during the year 1916 was not of a spectacular order, but rather along the line of continued research and development in fields already familiar. There are consequently no announcements of great scientific or technical importance which merit special mention, but nevertheless the year was one of such substantial progress in certain respects that the record would be incomplete without reference to a number of significant tendencies in the evolution of the art as a whole.

The previous year, 1915, had been marked by the successful attempts to employ the de Forest audion as a telephone repeater on a commercial scale, with the spectacular result that the dream of transcontinental telephony became a reality. Further progress has been made, during the year just closed, in the refinement and application of this remarkable invention, which promises, when fully utilized, to work a revolution in the art of wire transmission quite as important and extensive as that which succeeded the brilliant achievements of Pupin nearly two decades ago. Not only is this repeater efficient when employed in single units, but by reason of being unhampered by moving or vibrating mechanical parts it is remarkably free from distortion and capable of being applied in cascade or cumulative series combinations with great flexibility, as evidenced by some of the remarkable transcontinental demonstrations with which the public is now familiar.

The passing year also records considerable progress in the dissemination of knowledge concerning inductive interference phenomena and the development of a more sympathetic understanding, upon the part of power companies and telephone companies, of each other's problems. Similar tendencies are discernible in the evolution of safe principles of practice in the design and construction of joint aerial power and telephone lines. Progress in both of these directions has unquestionably been quickened by the attitude of the public service commissions and the Bureau of Standards, and while the industry has been disposed at times to feel that such supervision might result in burdensome rules or restrictions, there is after all nothing to fear in a reasonable solution of these problems worked out in conference of all interested parties and applied in a great spirit of fairness and justice to all those concerned.

The day has surely arrived when different utilities must evolve their separate destinies with due and proper regard for the interests of each other as well as the public whom they serve in common. Such co-operation between different classes of utilities will bring about as wholesome results as the increasing tendency for co-operation among the utilities of the various classes is already developing.





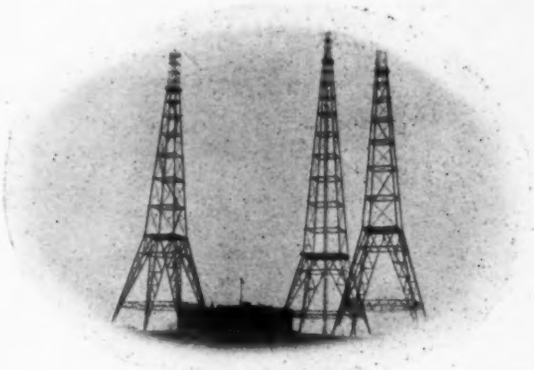
Standardization of telephone plant and operation has progressed to some extent, notwithstanding the counter effect of advances in the art. It is still characteristic of the industry, however, that the standards of today soon become the things of yesterday, although economic forces tend to restrain the needless or wasteful abandonment of equipment which has experienced the first encroachments of obsolescence but retains its full initial efficiency. The status of manual versus automatic equipment has undergone no marked change, but both systems have made progress in technical merit and commercial application. Undoubtedly the tendency in the progress of the manual system is toward the substitution of features which function automatically instead of manually, and in that sense the whole trend of the art is toward a larger degree of automatic operation. Another element which is exerting an influence in favor of automatic operation is the rising cost of labor and the increasing difficulty of obtaining it, especially in rapidly growing towns and cities. Automanual or semi-automatic systems have not progressed beyond the stage of experimental installation and their present position in the art is more in the nature of theoretical or potential importance than actual commercial significance.

Probably the most striking development of the year was the increased tendency of competitive operating groups to come into more harmonious and sympathetic commercial relations and in greater degree to regard their business as comprising collectively a single great industry instead of a house divided against itself. Changes in public sentiment toward local telephone monopolies, in recent years, have done much to bring about this change in commercial sentiment within the industry and in fact have made it possible. The public policy of the day unmistakably favors local telephone monopolies under regulation, as against divided service under competition. In numerous cases local mergers have been solicited or encouraged by public authorities with the approval of their constituencies, and with the result that one of the two competitors must retire or both join in creating a new corporation to absorb both plants.

It is obvious that this process of eliminating local competition in response to public demand for unified service leads to division of territory, but it is equally obvious that under a policy of "live and let live" there is opportunity for competitive operating interests to trade properties and territories, or to consolidate, with ample room for all interests to survive under much improved conditions. The ultimate working out of the present competitive situation along such lines will lead to a general condition of local regulated monopolies, under divers private ownership, interconnected by a countrywide network of toll lines likewise diversely owned, and representing universal service in the best sense, both economic and physical. This seems a good deal to hope for, but on the other hand it seems possible of accomplishment, with justice both to investors and the public, if the industry as a whole will work in harmony to such an end. The fact that even a beginning has been made marks the year as notable in the annals of the industry.

Wireless Telegraphy and Telephony

By PHILIP E. EDELMAN
Consulting Engineer



ON the whole, wireless development during 1916 has been substantial. The radio stations of the United States in the Bureau of Navigation list of July 1 comprise 452 land, 920 ship, and 5,255 amateur licensed stations, as compared respectively with 359 land, 895 ship, and 3,836 amateur stations for 1915. In numbers the government and commercial stations exhibit no material increase on land or water, but betterments are concealed in the figures. Noteworthy are the 55 stations listed as "limited commercial," which are suggestive of some of the newer applications of radio communication for intercompany business, between mines, factories and mills, between fixed and moving railroad stations, and between component stations of central-station networks. Such applications, just beginning, are bound to grow, not only because of the value in emergencies but because economies and advantages in competition with land wires are demonstrated.

Financially, growing earnings are reported generally. Foreign and domestic orders have kept the few American factories busy and some of the smaller concerns had to exert themselves to finance new business.

The patent situation maintains the ire in wireless progress. On September 20, 1916, Judge Mayer in the Federal District Court of New York decided that the Fleming valve patent No. 803,684 of November 7, 1905, owned by the Marconi company was infringed by the de Forest Radio Telephone & Telegraph Company's manufacture of the "audion" or three-electrode vacuum bulb detector. Also on October 12, 1916, Judge Hand of the Federal District Court enjoined the Marconi company from using this very "audion" or three-electrode gas relay or amplifier as covered by the several patents of the de Forest company. In the meantime the de Forest company has started proceedings against alleged small infringers, Moorhead, Hyde and others who have been making and selling a highly exhausted three-electrode tube called an electron relay and largely used for the same purposes. Passing over some of the minor cases and the injunction against the Atlantic Communication Company (Telefunken System) there is the suit of the Marconi company against the Kilbourne & Clark Company of Seattle, which has been decided in favor of the Kilbourne & Clark Company. The latter firm has been making apparatus according to the design of F. G. Simpson on the impact excitation principle as originally worked out by Wien, Nasmyth and others, and which, it has been contended, is not covered by the patents of the Marconi company.

Coming now to the patents for 1916 we find that the number issued this year is less than in preceding years, though this does not indicate a decrease in invention as many applications filed do not issue until several years later. A noteworthy point is the relatively large number of patents granted, not only in the United States but also in England, for audions, vacuum-bulb rectifiers, and electron-relay arrangements this year. These devices comprise essentially a heated filament and usually two cold electrodes in relation thereto, all in an evacuated vessel containing either some gas or practically none at all. Methods of securing high vacua have been greatly advanced by Dr. Langmuir and his colleagues so that substantially perfect vacua are obtainable. In such cases the electrons or negative electricity emitted by the heated filament can collide with no residual gas to produce ionization by collision and what is called a pure electron discharge results. This discharge is utilized for radio purposes by means of suitable auxiliary circuits to rectify, amplify, and convert electrical energy. Promising wireless-telephone sets using one or more such tubes are now being placed on the market.

Another improvement of note is the use of an energy-storing circuit in the transmitter generally consisting of a shunted capacity or capacity and inductance, which is used successfully with both arc and quenched-spark transmitters to increase the efficiency.

Not long ago the 350-kilowatt arc sets to be installed in the United States Government chain of radio stations excited awe. Rumor now says that a 5,000-kilowatt transmitter is under construction in Germany for later installation for transatlantic service. The tendency is to provide power far in excess of normal requirements in order to insure service during the worst possible conditions.

Portable sets have been improved and plans have been made to use radio communication for forest protection.

Quietly work has gone forward at the Bureau of Standards on what may prove to be valuable radio fog-signaling and direction-finding devices.

Commercial radio service has been established between San Francisco, Kahuku, Hawaii and Funabashi, near Tokyo, Japan, by relay and directly in the latter part of 1916. We learn that the cable companies are considering innovations in the form of Squier and audion circuits, possibly with a view to meeting the cut rates of the radio service. The Carnavon (Wales)-New Brunswick transatlantic stations, which will utilize balanced aerial circuits, are still closed. The transatlantic service with Germany has, under supervision of the United States Government, proven its worth repeatedly during 1916.

Commander Todd, U. S. N., has caused a new radio law to be proposed to Congress providing principally for restriction of foreign ownership of important radio stations.

Commendable work with low aerials or ground aerials during the year has shown that expected directional effects are obtainable and that messages can be received over 4,000 miles in this manner, though for transmitting purposes the low aerial is not very efficient despite the fact that Professor Culver has transmitted messages 100 miles.

Scientific advances have been mainly in the accumulation of additional data on transmission phenomena and improvements in methods of measurement of losses in radio circuits.

HAPPENINGS IN THE INDUSTRY

Tentative Organization of Engineering Standards Committee—Vacuum Cleaner Case Decided—Decree Rendered in Montgomery Case—Meeting of New England Section, National Association of Electrical Inspectors—Arrangements for Pittsburgh A. I. E. E. Meeting—Convention of American Association for Advancement of Science

TENTATIVE ORGANIZATION OF ENGINEERING STANDARDS COMMITTEE.

National Engineering Societies to Co-operate to Form Committe to Govern Engineering Standards.

An important committee meeting was held in New York City on December 29, made up of representatives of the national engineering societies, including the Society for Testing Materials, with the idea of forming a broadly representative body to govern engineering standards generally, patterned somewhat after the British Engineering Standards Committee. Representatives from each national engineering society were appointed, those from the American Institute of Electrical Engineers comprising Comfort A. Adams, professor of electrical engineering, Harvard University, Peter Junkersfeld, assistant to vice-president, Commonwealth Edison Company, Chicago, and Nathanial A. Carle, chief engineer, Public Service Electric Company, Newark, N. J.

VACUUM CLEANER CASE DECIDED.

Important Decision Handed Down by United States Circuit Court of Appeals, Establishing Basic Claims for Vacuum Cleaner Patents.

The United States Circuit Court of Appeals, for the Second District, New York, has affirmed the decision of the District Court in regard to the basic patent for vacuum cleaners in the United States which is claimed by the Vacuum Cleaner Company, of New York. Sometime ago the District Court for the Southern District of New York held valid the claims of the Vacuum Cleaner Company in regard to Kenny Patent No. 847,947, and granted a permanent injunction against infringement and an accounting of profits and damages subsequent to October, 1915. An appeal was taken to the United States Court of Appeals and the decision upheld.

In commenting on this decree this Vacuum Cleaner Company makes the following announcement:

"The decision rendered in our favor was of the strongest nature. This establishes our basic patent for vacuum cleaning in the United States, and unlicensed vacuum cleaners will now be prosecuted by injunctions and otherwise, and we shall endeavor to stop all infringements to this patent in every case.

OBJECTS TO COMMISSION REGULATING MUNICIPAL RATES.

Officials of Missouri Municipalities Propose New Law Giving Cities Authority in Rate Matters.

City officials of St. Louis and Kansas City, Mo., are working with officials of smaller towns of the state, towards new laws, and changes of the constitution, that will change radically the authority of the municipalities over public utilities. Speaking of these changes, one of the Kansas City officials said, after a conference with attorneys who had planned the movement:

"First, we want to secure for the cities, control by them of their own rates for water and electricity, when the utilities are owned by the municipalities. Under the present arrangement, the Public Utilities Commission controls the rates, which, of course, are regulated on the basis of the charge made and the costs of operating by privately owned plants as well as on the basis of the proper charges by the municipalities. We believe that it is the business only of a municipality, what charge it makes for its service.

"We also wish the laws and the constitution amended, if necessary, to give a city control of rates, and of other matters pertaining to utilities, in which the city may have a direct financial interest; the Kansas City street railway system is an example, wherein the city is virtually a partner, provision being made in the franchise for ultimate division of revenues, and possible purchase.

"We wish also to secure a change in the constitution, under which cities may issue bonds against utilities, which bonds shall not be counted against its debt-making powers. This will give Kansas City leeway for building its own electric light plant if it so desires."

The conference of city officials, and the announced purposes with reference to legislation, have special signficance in view of the recent decision of the Supreme Court of Missouri, upholding the finding of the Commission on the gas rate at Columbia, Mo. The Commission reduced the rate, the court upholding the Commission, and declaring that the public must not be required to pay rates that will result in dividends for a company, with that consideration as the only reason for the rates—that the basis of rates is the worth of the service, and the reasonable cost of giving it.

DECREE RENDERED IN LITIGATION OF MONTGOMERY PUBLIC SERVICE COMPANIES.

Judgment of $229,584.79, to Be Paid in Monthly Installments, Secured by Central Station.

A judgment of $229,584.79 in favor of the Montgomery (Ala.) Light & Water Power Company has been rendered against the Montgomery Traction Company by Federal Judge Clayton. The plaintiff in the case (the Montgomery Light & Water Power Company) is a public service corporation, manufacturing and selling electricity for light and power, and in 1903 entered into a contract with the defendant to supply energy for the operation of its street-railway cars. Afterwards the defendant erected a generating plant and engaged in the business of supplying electrical energy to the public for illumination and power purposes. About the time the defendant had completed its plant, the plaintiff filed a bill in court setting up that it had a contract with the defendant, and that by its terms the defendant had obligated itself to purchase from the plaintiff exclusively all the energy that might be required for the operation of its street-railway cars for a period of 15 years ending February 1, 1918, and alleging that it was the intention of the defendant to breach its contract with the plaintiff and that the defendant intended to supply its own current for the propulsion of its street railroad cars. The defendant contended that the plaintiff had not lived up to the terms and conditions of the contract and that, therefore, defendant had the right to declare the contract at an end.

The litigation growing out of this controversy has been long and continuous and the case has been stubbornly fought by both the parties. In December, 1914, a decree was entered in favor of the Montgomery Light & Water Power Company,

enjoining the defendant from obtaining its energy from any source other than from the plaintiff, so long as the plaintiff performed its part of the contract; and at the same time the court rendered a money judgment in favor of the plaintiff for energy that had been supplied by it to the defendant pending the litigation and from September 1, 1911, to February 1, 1913; and also reserved in said decree the power to make such other and further orders in reference to payment for energy in the future as might be deemed proper. This decree was affirmed by the Circuit Court of Appeals, and the application of the defendant to the Supreme Court of the United States for a writ of certiorari was denied.

On July 12, 1916, the defendant filed its petitoin for a dissolution of the injunction, and on August 8 the plaintiff filed its answer to the defendant's petition and asked for a decree against the defendant for the amount due and owing to the plaintiff by the defendant for electrical energy supplied to the defendant since February 1, 1913, which amounted to $229,584.79.

A considerable part of the opinion dwelt on the question of whether a judgment payable in installments would impair the lien of the winning company on the properties of the defeated corporation, and after citing both Federal and Alabama cases the jurist was firm in the conviction that the lien would be maintained until the entire judgment had been paid.

Under the decree of Judge Clayton, the traction company must pay $25,000 on January 12, and $11,000 on the twelfth of each succeeding month until the full amount, with interest, has been liquidated.

MEETING OF NEW ENGLAND SECTION NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS.

National Electrical Safety Code and Grounding of Alternating-Current Secondary Systems to Be Discussed at Winter Meeting on January 10.

The Western New England Section of the National Association of Electrical Inspectors will hold its regular winter meeting in the City Hall, Northampton, Mass., on January 10, 1917, starting at 10:00 a. m. The principal feature at the morning session will be an open forum on "The National Electrical Safety Code," which will be presented by W. J. Canada, of the Bureau of Standards, Washington, D. C. E. A. Braddell will preside during the forum.

An exhibit of the methods used by several inspection departments for keeping their inspection records will be made during the meeting.

At the afternoon session William H. Blood, Jr., insurance expert of the National Electric Light Association, will discuss the question of "The Grounding of Alternating-Current Secondary Distribution Systems." W. K. Tuohey, of Springfield, Mass., first vice-president of the National Electrical Contractors' Association, will preside during this session.

At the close of the afternoon session there will be an executive session for members of the Western New England Section.

THE ELECTRICAL MAN'S RESPONSIBILITY TO HIS COUNTRY.

H. M. Byllesby Points Out Importance of Preparedness to Electric Club-Jovian League of Chicago.

H. M. Byllesby addressed the Electric Club-Jovian League of Chicago, at its weekly luncheon December 28, at the Hotel Sherman, on the above subject. A large audience applauded his remarks on the need for preparedness, in the course of which he said:

"If the perils to our country, now so ominously emerging, are overcome it will be because we citizens calmly and with spiritual uplift immediately consecrate ourselves to that service to the state which each of us are best able to discharge. In this rising to the defense of our beloved country, which has showered so many opportunities upon us, the electrical man must be, and naturally will be, a factor of the first importance. The electrical man has had an experience of unique value which he can place at the disposal of his country. Modern defense against aggression, and modern war itself, resembles previous periods and conditions only in the fundamentals of devotion and inflexible resolve, of physical fitness and heroism; in all other details it has become a matter of headwork, of the closest kind of mental concentration, and application of engineering, and largely electrical engineering—a matter of resource and adaptation of means to an end. The electrical man, imbued with the inspiration of his great achievements and the inspiriation he has inherited from the great founders and leaders of the industry, is peculiarly prepared for his share in the defense of his country."

ARRANGEMENTS FOR PITTSBURGH MEETING OF AMERICAN INSTITUTE.

Subject of Braking Electric Vehicles by Regeneration to Be Discussed—Inspection Trips Planned.

The American Institute of Electrical Engineers will hold its next meeting in Pittsburgh on January 12, 1917, with headquarters at the Fort Pitt Hotel.

Following the policy adopted a short time ago, the Institute, instead of confining its session to one annual meeting during the year, has decided to hold several meetings at stated intervals in various parts of the country.

The Pittsburgh meeting will be devoted to a discussion of "Braking Electric Vehicles by Regeneration," using the energy generated on down grades to apply brakes to the vehicles.

The paper on this subject will be presented by R. E. Hellmund of the Westinghouse Electric & Manufacturing Company. The meeting will be presided over by Harold W. Buck, of New York City, president of the Institute.

Several hundred delegates are expected to attend. The morning will be devoted to a meeting of the Board of Directors of the Institute, and the afternoon to an excursion to the various industrial plants in the Pittsburgh district. The session of the Institute will be held in the English Room of the Fort Pitt Hotel, in the evening, preceded by an informal dinner.

ELECTRICAL SUBJECTS AT AMERICAN ASSOCIATION FOR ADVANCEMENT OF SCIENCE CONVENTION.

Numerous Interesting Papers Discussed at the Annual Meeting in New York City.

At the annual meeting of the American Association for the Advancement of Science, which was held in New York City, December 26 to 30, one day was devoted largely to a discussion of electrical topics. Among the interesting papers presented at this session, which was held on December 29, were the following: "Independent Laboratories in the Engineering Industries," by Clayton H. Sharp, Electrical Testing Laboratories, New York City; "The Engineer and the Newspaper," by Henry A. Wise Wood, New York City; "A Study of the Relation Between Tension and Magnetic Permeability," by Prof. J. T. Rood, Lafayette College, Easton, Pa.; "Considerations on the Design of Air-Core Transformers," by Prof. Walter L. Upson, Union College, Schenectady, N. Y.; "State Engineering Experiment Stations and Government Promotion of Industrial Research," by P. V. Stephens, New York City.

A session was held at 8:30 p. m., on December 29, the subject of which was the "Inter-Relationship of Engineering and Pure Science." This session was held under the auspices of the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers and American Institute of Electrical

Engineers, and representatives from each organization delivered addresses.

Following this session there was a reception in the Engineering Societies Building, tendered by the combined associations, followed by a dance.

The usual exhibition of scientific apparatus and results was held in conjunction with the convention at University Hall, Columbia University. The Bureau of Standards had a very interesting exhibit of rare-gas and vacuum lamps and also a small metric exhibit. Other exhibits of electrical interest were maintained by James G. Biddle, General Electric Company, Research Laboratory of the Eastman Kodak Company, Leeds & Northrup Company, Nela Research Laboratory of General Electric Company, and the Western Electric Company.

New York Edison Company Presents Christmas Tree to City.

For the second consecutive year, the New York Edison Company has added to the joy of thousands of children

New York Edison Company's Overhead Christmas Tree.

living in the vicinity of its Forty-second Street offices by installing a handsomely decorated tree in front of its offices. The tree is about 50 feet high and is on a special balcony built over the entrance to the company's display room. Hundreds of incandescent lamps, of various colors are used to decorate the tree which can be plainly seen for several blocks.

The Manufacture of Steel.—In the large hall of the Classical High School, Lynn, Mass., on December 20, T. N. Speller delivered a lecture on the "Manufacture of Steel from the Ore to the Finished Product," before the Lynn Section, American Institute of Electrical Engineers. After a brief discussion of the history of iron and steel the speaker was enabled, by means of motion pictures, to give a graphic idea of the various processes of mining and shipping ore, and mill manipulation of iron and steel, the color effects in blast furnace work in making tubing, etc., being very realistic. Mr. Speller is metallurgical engineer of the National Tube Company, and was the originator of many special processes, one of which is known as "Spellerizing."

CHANGES IN ELECTRICAL RULES.

Standardization Rules of the American Institute of Electrical Engineers Have Been Revised.

A revision of the Standardization Rules has been made by the Standards Committee and adopted by the Board of Directors of the American Institute of Electrical Engineers. Many of the changes are inconsequential, but all cases in which the substance of a rule has been altered are noted below.

The principal addition to the rules consists of five sections relating to the rating of automobile propulsion motors and generators, numbered 835 to 839. Such machines shall be given a continuous rating, expressed in kilowatts output available at the shaft at specified speed and based upon a temperature rise, on a stand test and with motor covers arranged as in service, 15 degrees by thermometer or 25 degrees by resistance, above those allowed for stationary machinery. When such machines are of low voltage, brush-contact losses must be determined experimentally for the type of brush used. No single standard period for short-time ratings is recommended.

Section 386A constitutes another addition. In an inclosed machine the limiting observable temperature and the limiting observable temperature rise shall be taken as five degrees centigrade higher than in Table IV. This is in recognition of the lesser difference between the hottest spot and the observed temperature in an inclosed machine. It does not apply to semi-inclosed, separately ventilated or self-ventilated machines.

The sections on meters and instruments contain some new definitions, including reactive volt-ammeter, demand meter, integrated-demand meter and lagged-demand meter. Torque shall be expressed in millimeter-grams. Instrument errors shall be expressed in percentage of the full scale reading. The definition of crest voltmeter has been altered so that it applies only to instruments calibrated to read root-mean-square value of the sine wave having the same crest value, and not to instruments indicating the actual crest or maximum value.

Section 275 has been amended so that the kilovolt-ampere rating of alternators and transformers is no longer to be amplified by stating the corresponding kilowatts.

For machines operating under specified duty cycles, 15 minutes has been added as one of the standard durations of equivalent tests. (Section 285.)

In tests for temperature rise, the minimum limit of desirable ambient temperature has been changed from 20 degrees to 15 degrees centigrade. (Section 320.)

In temperature measurements by resistance, a correction shall be applied to transformers of 240 kilovolt-amperes or less, amounting to one degree for each minute between the instant of shutdown and the time of final temperature measurement, provided this interval does not exceed three minutes. (Section 348.) The measurement of temperature by resistance, where joints and connections form a considerable part of the total resistance of a low-resistance circuit, may be applied only to transformer windings. (Section 350.)

Efficiency and Losses.

Several changes are to be noted in the sections dealing with Efficiency and Losses. In calculating plant or system efficiency it may be desirable to calculate the losses in each individual machine or part of the system at its actual temperature. These losses may be different from the losses at 75 degrees centigrade, which is the standard temperature of reference for all efficiency guarantees (Section 421).

The efficiency specified for alternators and transformers shall be the ratio of kilowatt output to kilowatt input at the rated kilovolt-amperes and power-factor (Section 430).

In considering the losses to be taken account of in synchronous motors and generators, brush friction and brush-contact loss are not negligible in the case of machines with revolving armatures (Section 441).

Core loss in a rotating machine is to be determined with an excitation such that the terminal voltage corresponds to the calculated internal voltage for the load under consideration (Sections 452 and 453).

The procedure for determining stray load losses in induction machines, as given in Section 459, has been amended. With the rotor removed, measure the power input to the stator with different values of current at the rated frequency. The curve plotted with these values gives the combined I^2R and stray load losses due to eddy currents in the stator copper. Deduct the I^2R loss determined from the resistance, and the remainder will represent the stray load losses corresponding to the various currents. While this method is not accurate for some types of motors it usually represents a sufficiently good approximation.

Dielectric Strength.

In tests for dielectric strength of all standard devices produced in large quantities for which the standard test pressure is 2,500 volts or less, a test pressure applied for one second 20 per cent higher than the one-minute test pressure will be satisfactory (Section 485A).

In Section 507, giving exceptions to the standard test voltage for the field windings of synchronous machines, the limit of excitation voltage between 5,000 and 8,000-volt tests for open-circuit series windings has been changed from 250 to 275 volts.

Another exception has been added, applying to meters and instruments, for which no test voltages are specified (Section 510A).

In Table IX, Section 540, giving sphere-gap spark-over voltages, the gap for 30 kilovolts with spheres 62.5 millimeters in diameter has been changed from 13.5 to 14.1 millimeters.

Transformer Connections.

The rules for marking transformer leads have been changed. In single-phase transformers having three or more windings, the high-voltage leads shall be marked *AB, AA BB,* etc., and the low-voltage leads *XY, XX YY,* etc. (Section 604.) All tap connections which are not brought outside the transformer case shall be marked serially with numbers only. Where tap leads are brought out of the transformer case they shall be given the letter designation together with a subscript indicating the relative position of the tap, as X_1 (Section 605). For transformers having six-phase secondaries the primary leads should be lettered *A, B, C,* and the secondary leads *U, V, W, X, Y, Z.* In three-phase transformers the letters should be so applied to the transformer terminals that if the phase sequence of voltage on the high-voltage side is in the order *A, B, C,* it is in the order *X, Y, Z,* on the low-voltage side (Section 608).

Miscellaneous.

Sections 623 to 630 inclusive, giving information to be placed on rating plates of machines, have been dropped.

Table XIII, Section 655, giving the stranding of flexible cables, has been altered and enlarged. Section 657 has been added, reading as follows: The lay of any layer of wires of a cable or strand shall not exceed 15 times the pitch diameter of that layer. The lay of any layer of strands of rope-lay cables shall not exceed 12 times the pitch diameter of the layer.

In testing insulation resistance of insulated conductors, the conductor should be negative to the sheath or water in which it is immersed (Section 692). This rule formerly required it to be positive.

Sections 859, 861, 862 and 896, dealing with Illumination, have been dropped. So has Section 1029 in the appendix, on the rating of radio transmitting sets.

Indiana New-Business Committee Meeting.

The first of two meetings to be held by the New-Business Committee of the Indiana Electric Light Association during 1917 will be held in Muncie, Ind., on January 23. It is expected that the subject of electric cooking will be given prominence on the program, particularly the plans for the proposed state-wide electric-range campaign.

O. M. Booher, of Kokomo, Ind., is chairman of the committee.

Notable Flood Lighting in Minneapolis

The above illustration shows the flood lighting of Gateway Park Building which is situated at what might be termed the entrance to the city of Minneapolis, at least so far as the Union Depot is concerned. As will be noted, the architecture does not lend itself to flood lighting, although the effect, as shown, is extremely pleasing. The installation was made by the Minneapolis General Electric Company and was first turned on during America's Electrical Week. Members of the Park Board of Minneapolis were very much pleased with the installation and undoubtedly other public structures in the city will be similarly lighted. As a Christmas remembrance to members of the Board and the mayor, the Minneapolis General Electric Company had photographs of the installation taken and framed which were presented to each member on Christmas morning.

Statistics on Railway Electrification

A Compilation of Authentic Data Showing the Total Mileage of Electrified Trunk Lines, Interurban and Elevated Railroads in the United States

I—TRUNK LINES OPERATED AS SUCH

RAILROAD	LOCATION	System	Contact Voltage	MILES OF		Motor Cars	Locomotives
				Line	Track		
Baltimore & Ohio	Baltimore Tunnel	DC	600	4	8	.....	9
Boston & Maine	Hoosac Tunnel	AC	11000	8	22	.....	5
Butte, Anaconda & Pacific	Butte-Anaconda	DC	2400	30	91	.....	21
Canadian Northern	Montreal Terminal	DC	2400	10	30	8	6
Chicago, Milwaukee & St. Paul	Harlowton-Avery	DC	3000	438	650	.....	44
	Great Falls Terminal	DC	2400	4	7	.....	1
Erie	Rochester-Mt. Morris	AC	11000	34	40	8	.....
Grand Trunk	St. Clair Tunnel	AC	3300	4	12	.....	6
Great Northern	Cascade Tunnel	AC*	6600	4	10	.....	4
Long Island	New York-Long Island	DC	650	89	217	591	.....
Michigan Central	Detroit River Tunnel	DC	650	4	26	.....	10
New York Central & Hudson River	New York-Croton-North White Plains	DC	650	53	255	192	63
New York, New Haven & Hartford	Woodlawn-New Haven	AC	11000	60			
	Stamford-New Canaan	AC	11000	8			
	Harlem River-New Rochelle	AC	11000	11	570	54	115
	Providence-Fall River	DC	660	23			
	Nantasket-Pemberton	DC	575	7			
New York, Westchester & Boston	Port Morris-White Plains	AC	11000	18	63	30	1
Norfolk & Western	Bluefield-Vivian	AC	11000	26	90	.....	12
Pennsylvania	Camden-Atlantic City	DC	700	75	150	109	.....
	New York-Newark	DC	650	19	99	68	33
	Philadelphia-Paoli	AC	11000	20	94	93	.....
Southern Pacific	Oakland-Berkeley	DC	1200	118	138	91	.....
	Portland and vicinity	DC	1500	146	162	72	3
Spokane & Inland Empire	Spokane-Moscow, etc	AC	6600	127	131	59	13

II—ELECTRIFIED ROADS OPERATING AS INTERURBANS

RAILROAD	LOCATION	System	Contact Voltage	MILES OF		Motor Cars	Locomotives
				Line	Track		
Centerville, Albia & Southern	Centerville-Albia (Iowa)	DC	600	25	25	3	.....
Charles City Western	Charles City-Marble Rock (Iowa)	DC	1200	25	30	4	1
Chicago, Aurora & De Kalb	Aurora-De Kalb	DC	600	.....	30	5	.....
Chicago, Burlington & Quincy	Deadwood-Pluma (S. D.)	.....	.....	.....	4	3	.....
Cincinnati, Georgetown & Portsmouth	Cincinnati-Georgetown-Russellville	DC	600	.....	57	20	.....
Cripple Creek & Colorado Springs (Colo. & Southern)	Cripple Creek-Colorado Springs	DC	585	18	18	7	.....
Denver & Interurban (Colo. & Southern)	Denver-Boulder	AC and DC	11000 575	44	52	14	.....
Evansville, Henderson & Owensboro (Illinois Central)	Evansville-Henderson (Ky.)	.....	.....	.....	11	3	.....
Everett Railway, Light & Water (Northern Pacific)	Lowell-Snohomish	DC	550	9	10	16	.....
Fort Dodge, Des Moines & Southern	Des Moines-Boone-Fort Dodge	DC	1200	.....	17	.....	11
Hull Electric Co (Canadian Pacific)	Ottawa-Hull-Aylmer	DC	600	.....	28	34	.....
Huntington Railroad (Long Island)	Huntington-Amityville (N. Y.)	DC	600	.....	20	13	.....
International Railway (Erie Railroad)	Buffalo-Lockport	DC	615	18	25	.....	2
Jamestown, Westfield & Northwestern	Jamestown-Mayville	DC	625	28	40	9	1
London & Port Stanley	London-Port Stanley (Ont.)	DC	1500	24	30	6	3
Maryland Electric (Annapolis Short Line)	Baltimore-Annapolis	DC	1200	25	37	13	1
Michigan Railway (Michigan Central)	Battle Creek-Allegan	.....	.....	.....	41	.....	.....
Montreal & Southern Counties (Vermont Central)	Near Montreal	DC	600	.....	18	31	.....
New York State Rys. (Oneida Line) (New York Central)	Utica-Syracuse	DC	650	89	217	25	.....
Niagara Junction	Niagara Falls	DC	600	3	12	.....	2
Norfolk Southern	Norfolk-Virginia Beach	DC	575	.....	47	25	.....
Ohio Electric (Columbus & Lake Michigan)	Lima-Defiance	DC	600	.....	42	.....	.....
Poughkeepsie City & Wappingers Falls (Cent. New England)	Poughkeepsie-Wappingers Falls	DC	600	.....	18	27	.....
Rock Island Southern (C. R. I. & P.)	Monmouth-Galesburg	DC	600	20	25	4	.....
	Davenport-Rock Island	AC	11000	50	81	6	2
Salt Lake & Ogden	Salt Lake-Ogden	DC	750	.....	60	18	.....
Southern Oregon Traction	Medford-Jacksonville	DC	600	.....	10	1	.....
Visalia Electric (Southern Pacific)	Visalia-Red Bank	AC*	3300	31	49	6	1
Washington & Old Dominion	Washington-Great Falls	DC	650	52	98	25	.....
Washington, Baltimore & Annapolis (Baltimore & Ohio)	Annapolis Junction-Annapolis	DC	1200	19	19	.....	.....

III—ELEVATED RAILROADS

RAILROAD	LOCATION	System	Contact Voltage	MILES OF		Motor Cars	Locomotives
				Line	Track		
Brooklyn Elevated	Brooklyn Bridge	DC	600	2	6	.....	.....
Chicago & Oak Park	Chicago	DC	600	.....	23	.....	.....
Manhattan Elevated	New York	DC	600	.....	118	.....	.....
Metropolitan, West Side	Chicago	DC	600	.....	60	.....	.....
South Side Elevated	Chicago	DC	600	.....	46	.....	.....

*All the alternating-current roads (designated by AC) operate at a frequency of 25 cycles on the single-phase system, except the Great Northern, which is 25 cycles 3 phase, and the Visalia Electric, which is 15 cycles single phase.

Lighting a Large Motion-Picture Studio

Unique Features of the Artificial Lighting System, Particularly the Convenient Movement, Adjustment and Control of the Various Lighting Equipment Units

By J. HOWARD SANDIDGE

SOME interesting features are embodied in the recent installation of a complete artificial lighting system in the new studio of the Rothacker Film Manufacturing Company, Chicago, especially in the methods used for control and handling of the lighting equipment. These are described in this article with special reference to their electrical significance.

The studio is of the type now nearly standard and resembles a long hall, its dimensions being 125 by 52 feet with about 25 feet clear height. "Sets" or "stages" are built along one side of the studio, the maximum number in this case being five or six, and are photographed from the other side of the studio.

Lighting Requirements.

"Top" light must be furnished from above each set and "side" illumination from the sides and front of the set. Flexibility of light effects is absolutely essential, both with respect to top and side light; in fact, it must be possible practically to mold the illumination into the set in much the same manner that a founder fills the crevices of a pattern with sand.

In addition to this primary requirement, the various light effects must be quickly and simply attainable, and the whole lighting equipment must be movable along the length of the studio, to furnish light for sets which have been constructed while the action in others is being photographed.

General Scheme of Lighting.

The overhead structure adopted for this purpose consists of a double-girder crane, running on tracks supported by the side walls of the studio and spanning the 52-foot width of the building. The two girders of the crane are separated 26 feet 6 inches, but are rigidly fastened together by a series of I-beams, parallel to the length of the studio, from which the overhead lighting equipment depends. The whole crane system moves on four flanged wheels, at present by hand-operated continuous chain and gear mechanism, although provision is made for electrical traverse.

Overhead, top or skylight effect (see Fig. 1) is obtained from five rows of "skylight frames," each frame consisting of eight 50-inch automatic-starting mercury-vapor tubes with porcelain-enameled reflectors to direct the illumination down-

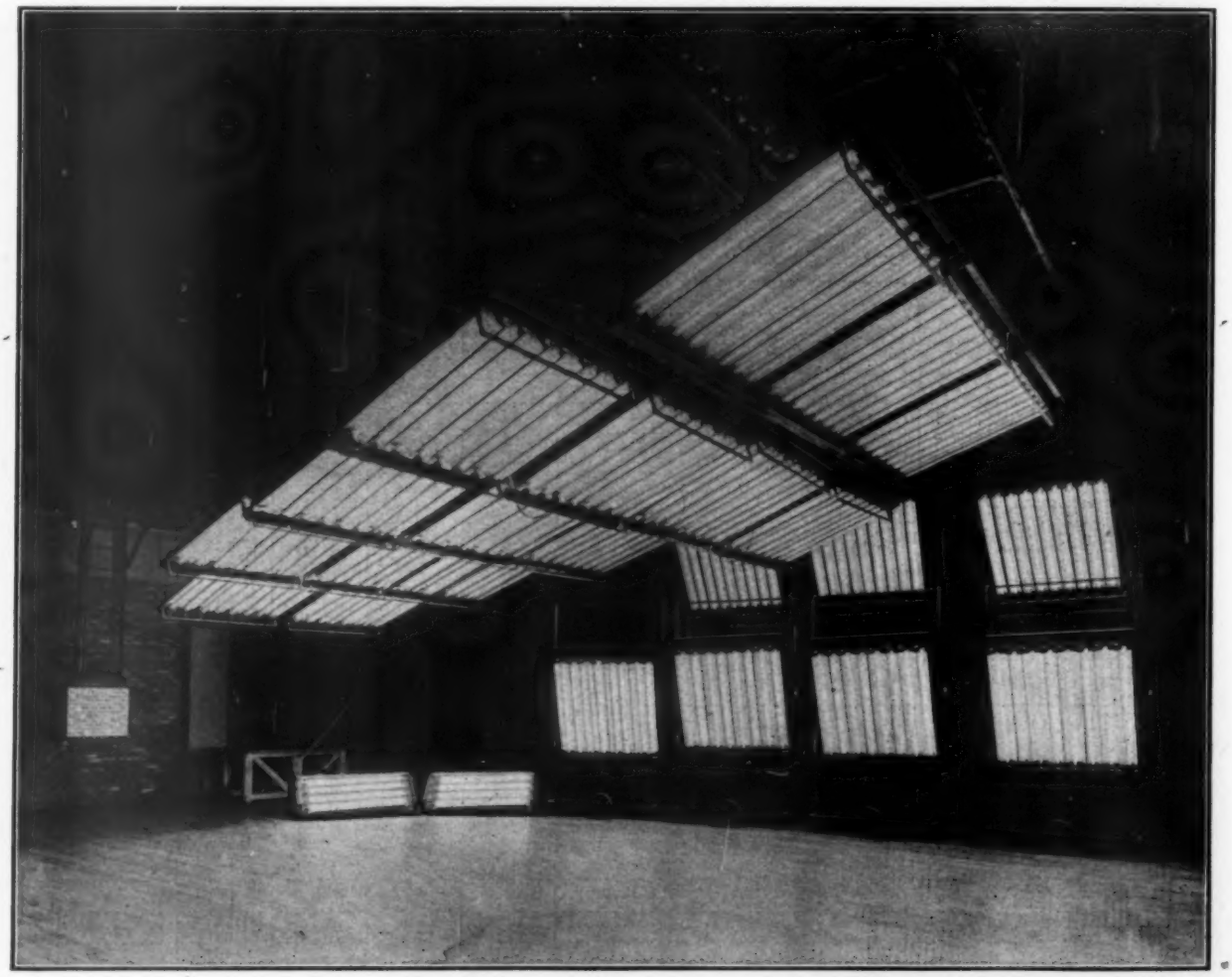
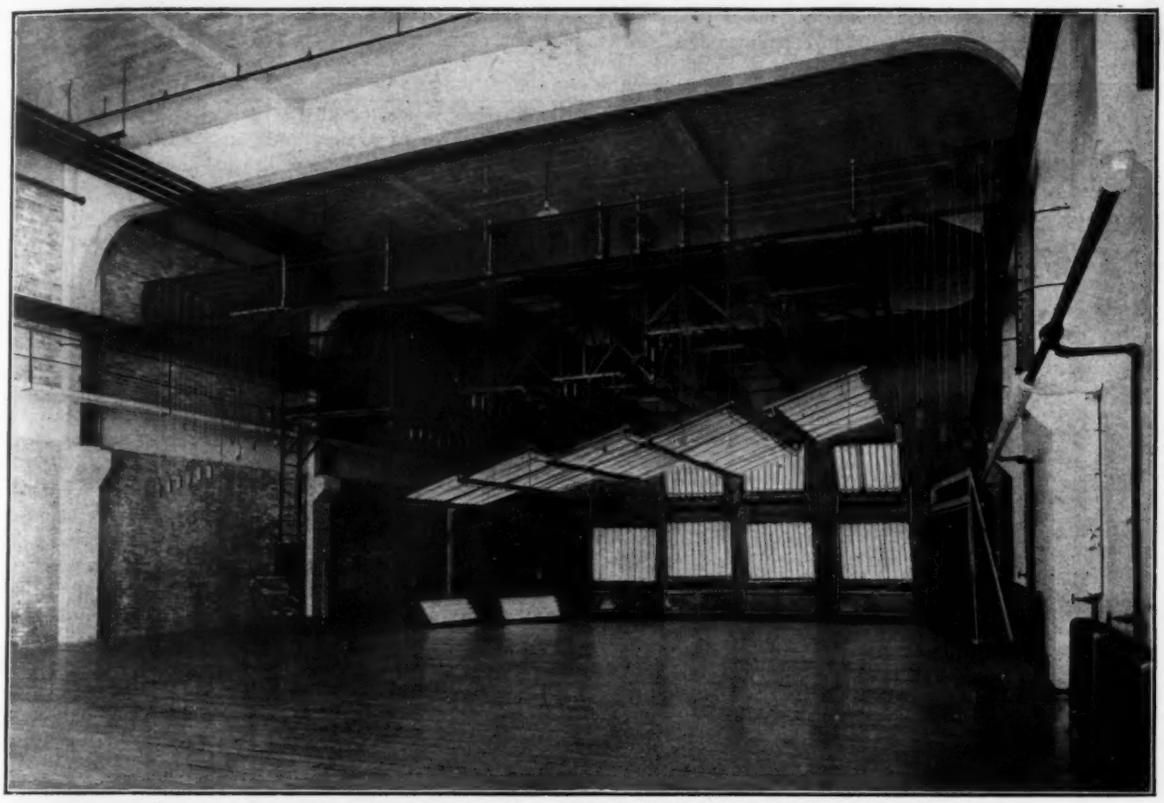
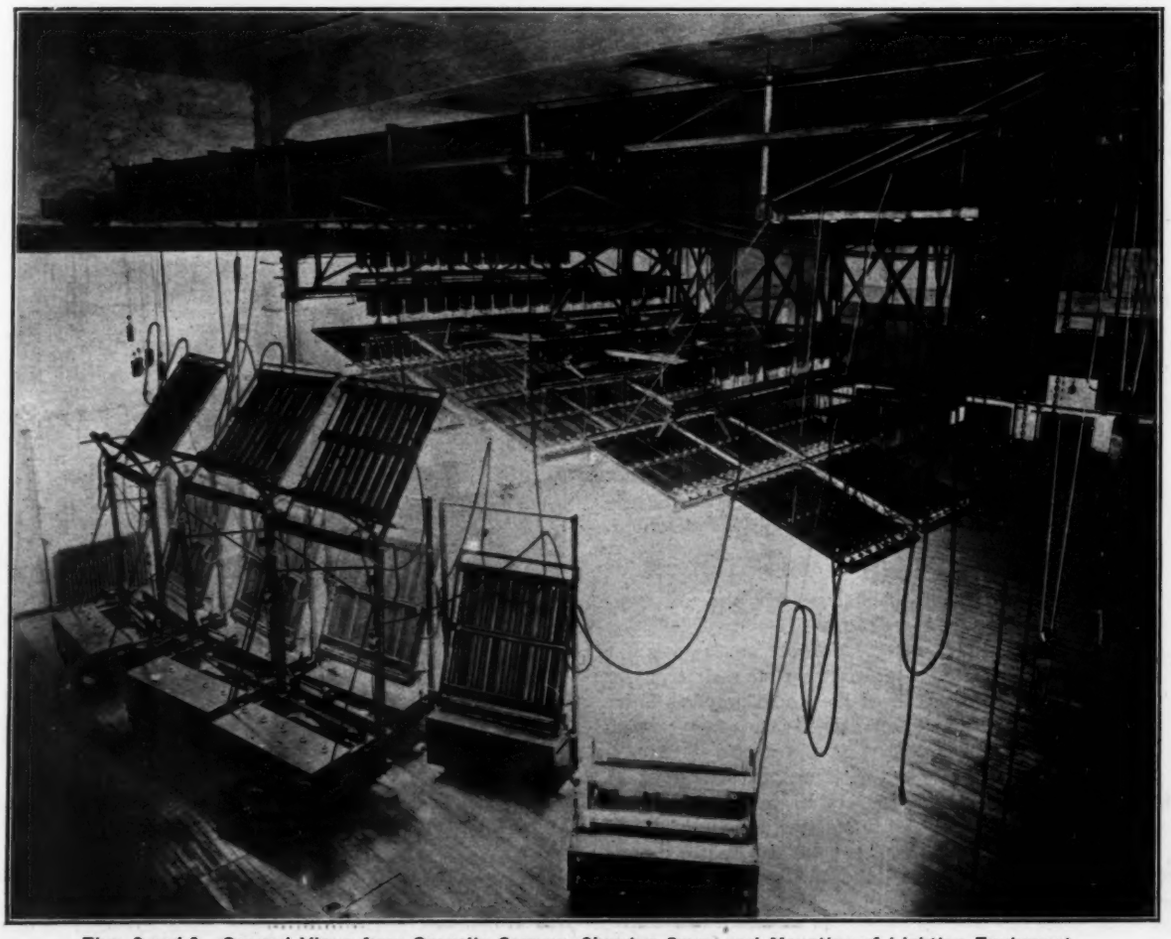


Fig. 1.—Close View of the Mercury-Vapor-Tube Lighting Equipment in Rothacker Film Studio.





Figs. 2 and 3.—General Views from Opposite Corners, Showing Crane and Mounting of Lighting Equipment.

ward. The back row, that is, the row over the rear of the set and farthest from the camera, has three frames (24 tubes), the second row four frames, the third three frames, the fourth

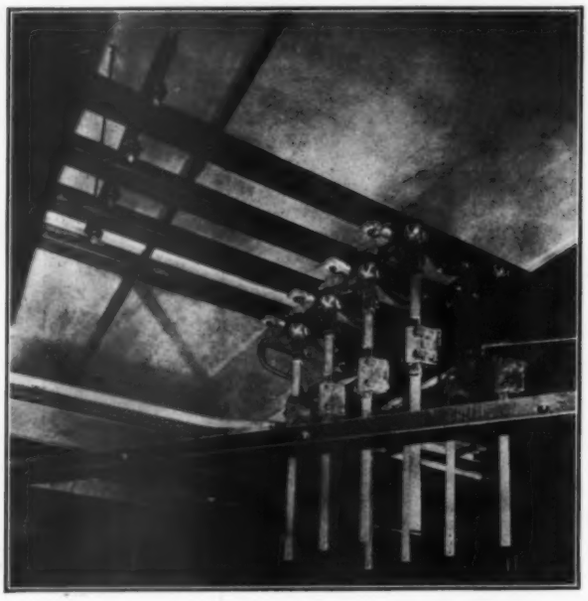


Fig. 4.—Four Inverted T-Bar Working Conductors on Ceiling and Special Sliding Collectors on Crane.

row three frames (one has five tubes only) and the fifth row two frames.

These frames ordinarily slant away from the camera and toward the set, forming a practically continuous plane at an angle with the floor (see Figs. 1 and 2). However, they are not supported rigidly in this position and may, by a simple crank and cable device on each row, be raised, lowered or changed in angle with respect to the floor. In addition to this movement all rows of frames, excepting the second, may be moved on the crane itself, in the line of its travel, to a point where either end frame of any row will assume a position past the side girder. This is necessary to facilitate photographing diagonally across the studio. The rows are supported on ball-bearing roller hangers which traverse in tracks clamped to the bottoms of the I-beams extending from girder to girder and are easily movable by simple rope loops extending to the floor at the front corner of the crane.

Side illumination is furnished by lamps on stands, 15 outfits being used in all. Four of these are equipped with eight 50-inch mercury-vapor tubes each, three with nine each and two with four each, the remaining six being 30-ampere arc lamps. All of this apparatus is equipped with ball-bearing rollers or casters for easy movement on the studio floor and is supplied with current in a novel way, to be hereinafter described.

Main Electrical Supply System.

Energy is delivered into the building from the Commonwealth Edison Company's three-phase 220-volt distribution mains, and is conducted to two 50-kilowatt motor-generator sets located in the rear of the basement, the starters for which are placed at the rear end of the studio proper. These sets generate 110-volt direct current which, after passing through a simple switchboard next to the motor starters, is conducted through two heavy main circuits to the ceiling of the studio, where each of the four cables is connected to a 3.5 by 3.5 by 0.5-inch inverted T-bar of structural steel. These four conductor bars, properly insulated, run on 12-inch centers down the entire length of the studio and supply current for the crane.

Extending upward from the crane and pressing on the bottom surfaces of the inverted T-bars are four sets of special sliding collectors (Fig. 4) from which the current passes into cables extending into the main switch box (Fig. 5) on the platform of the crane.

Arrangement of Branch Circuits.

In this box is located all the control and protective apparatus for the various groups of lights. Each of the two main circuits first passes through a 400-ampere remote-control switch and thence to a distribution and fuse board. The two fuse boards are located at the sides of the box and feed their circuits toward the center of the box, one supplying energy for all overhead lights and one for all floor lights; see Fig. 6 for the general scheme of wiring.

Fifteen circuits of No. 8 conductors from the overhead-light board pass through the same number of 60-ampere remote-control switches and directly out of the back of the box, each terminating directly above the skylight frame which it supplies, while from the floor-light board 15 circuits of No. 6 conductors lead through an equal number of similar switches and thence out of the box to the flanges of the girders. The box is so placed that the conduits issuing from it extend directly to their various terminations, being supported on the tops of the I-beams which carry the rows of overhead lights.

Each bank of overhead lights is fed through a stage cable which is spliced to the conductors of each circuit inside of the terminating conduit fitting above the skylight frame, enough slack being left in the cable to permit the moving of the row of skylights. These cables each lead into a small fuse box located on top of the board which supports the auxiliaries for the group of tubes that the cable feeds. Each lamp is protected by two plug fuses and current is fed through two No. 14 wires in loom from the fuse box to the auxiliary. Each tube is fed with current from its auxiliary through extra flexible duplex conductors, enough slack being provided to permit the tube frames to be raised, lowered, or adjusted in angle.

The floor-light circuits extend in conduit from the back of the large switch box to the outer bottom flanges of the main

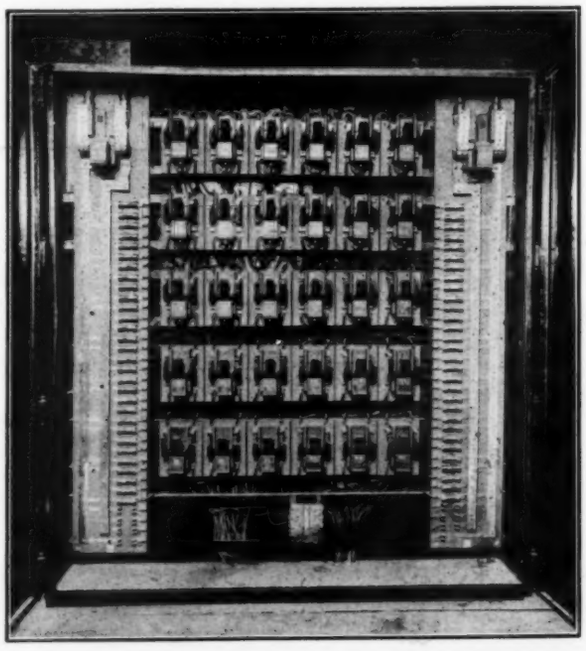


Fig. 5.—Main Switch and Fuse Box on Platform of Crane, Including Two Main and 30 Branch Circuit Switches, all Remote-Controlled.

girders, eleven outlets being provided on each girder. These outlets are spaced conveniently along the length of the girders, each supporting a length of stage cable sufficient to permit any floor light into which it is plugged to be moved over 20

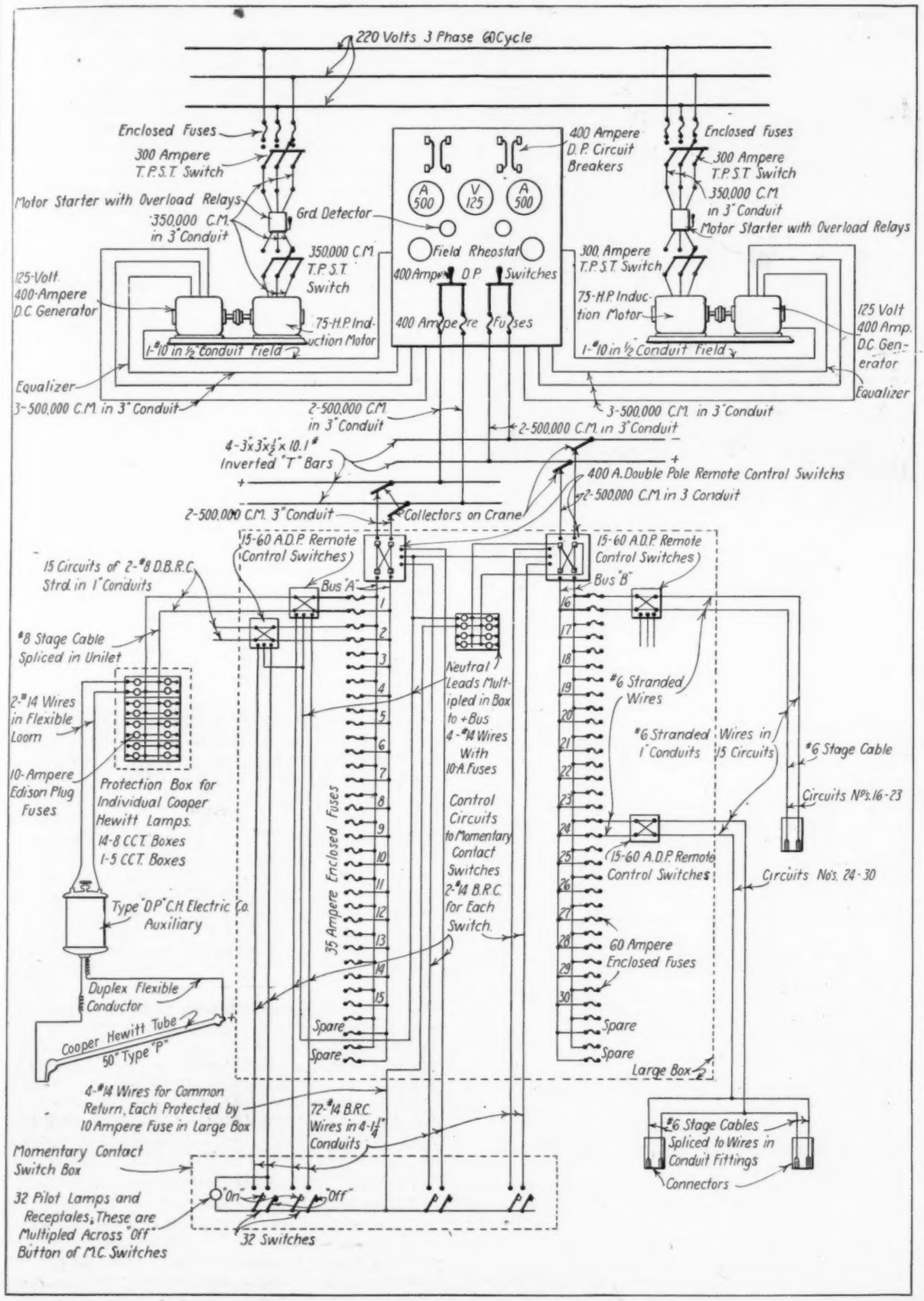

220 Volts 3 Phase 60 Cycle
Enclosed Fuses
300 Ampere T.P.S.T. Switch
Motor Starter with Overload Relays
350,000 C.M. in 3" Conduit
Grd. Detector
350,000 C.M. T.P.S.T. Switch
125-Volt 400-Ampere D.C. Generator
75-H.P. Induction Motor
1-#10 in ½ Conduit Field
Equalizer
3-500,000 C.M. in 3" Conduit
400 Ampere D.P. Circuit Breakers
A 500
V 125
A 500
Field Rheostat
400 Ampere D.P. Switches
400 Ampere Fuses
Enclosed Fuses
300 Ampere T.P.S.T. Switch
350,000 C.M. in 3" Conduit
Motor Starter with Overload Relays
300 Ampere T.P.S.T. Switch
75-H.P. Induction Motor
1-#10 in ½ Conduit Field
125 Volt 400 Amp. D.C. Generator
Equalizer
3-500,000 C.M. in 3" Conduit
2-500,000 C.M. in 3" Conduit
2-500,000 C.M. in 3" Conduit
4-3"x3"x½"x 10.1# Inverted "T" Bars
400 A. Double Pole Remote Control Switchs
2-500,000 C.M. in 3 Conduit
2-500,000 C.M. 3" Conduit
Collectors on Crane
15-60 A.D.P. Remote Control Switches
15-60 A.D.P. Remote Control Switches
15 Circuits of 2-#8 D.B.R.C. Strd. in 1" Conduits
Bus "A"
Bus "B"
#8 Stage Cable Spliced in Unilet
2-#14 Wires in Flexible Loom
10-Ampere Edison Plug Fuses
Protection Box for Individual Cooper Hewitt Lamps. 14-8 CCT. Boxes 1-5 CCT. Boxes
Type "DP" C.H. Electric Co. Auxiliary
Duplex Flexible Conductor
Cooper Hewitt Tube 50" Type "P"
Neutral Leads Multipled in Box to + Bus 4-#14 Wires With 10 A. Fuses
Control Circuits to Momentary Contact Switches 2-#14 B.R.C. for Each Switch.
35 Ampere Enclosed Fuses
Spare
Spare
#6 Stranded Wires
#6 Stranded Wires in 1" Conduits
15 Circuits
#6 Stage Cable
Circuits Nos. 16-23
Circuits Nos. 24-30
15-60 A.D.P. Remote Control Switches
60 Ampere Enclosed Fuses
Spare
Spare
Large Box
4-#14 Wires for Common Return, Each Protected by 10 Ampere Fuse in Large Box
72-#14 B.R.C. Wires in 4-1¼" Conduits
#6 Stage Cables Spliced to Wires in Conduit Fittings
Connectors
Momentary Contact Switch Box
32 Pilot Lamps and Receptales; These are Multipled Across "Off" Button of M.C. Switches
"On"
"Off"
32 Switches

Fig. 6.—Wiring Diagram for Lighting of Rothacker Film Studio, Chicago, Ill.

feet in any direction on the floor. The cables terminate in uniform connectors, as shown in Figs. 2 and 3, which normally hang about 10 feet from the floor, high enough to clear the wings of the stage setting, being elevated to this height by counterbalance weights. All floor lights have similar re-

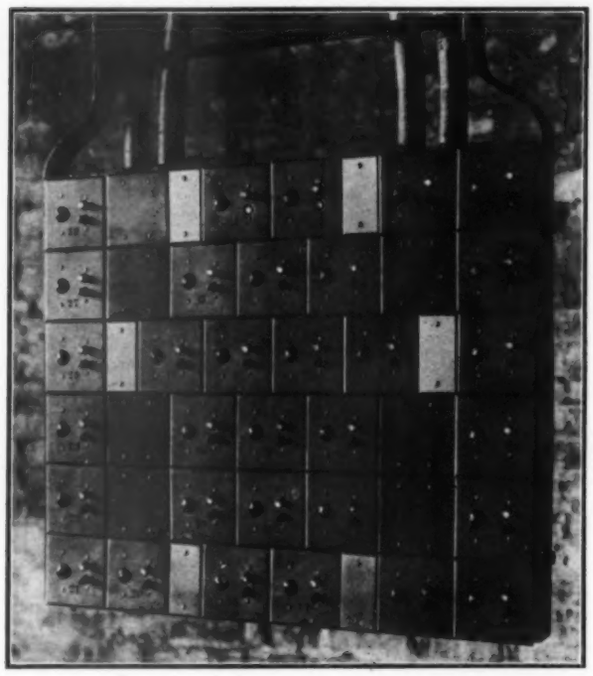


Fig. 7.—Lighting Control Panel with 32 Momentary-Contact Control Switches and Pilot Lamps, Rothacker Studio.

ceptacles into which any one of the hanging cable connectors may be plugged. The cable connectors are pulled down by a short rod with a suitable claw and are counterbalanced heavily enough to take up all slack in the cable and to rise smartly to their normal position after being disconnected.

Fifteen floor-light circuits supply 22 outlets by operating seven outlets on each girder over the rear of the stage in multiple, each cable termination being permanently marked "multiple," and having its take-up device interconnected mechanically with the other termination of the same circuit, so that only one of each multiple pair of cables may be pulled down for use. The photographic requirements for floor lights at the rear of the stage further the practicability of this arrangement, as the light sources are almost universally necessary from only one side of the set at a time.

Control of Lights.

Control of all lights, both floor and overhead, is centered in a small box or panel (Fig. 7) at the front of the set, which is rigidly supported by structural-steel members from the crane, as shown in Figs. 1 and 2. The face of the box is 27 by 31 inches and consists of brass push-button switch plates.

Thirty-two momentary-contact push-button switches are arranged in the box so as to form a sort of diagram of the lighting equipment. The 15 overhead skylight frames are controlled by switches that are symmetrically grouped in the center of the box, each row of frames having a corresponding number of switches, the switches having the same relative position as the skylights on the crane. The switches controlling the hanging cables for floor lights are arranged along the sides of the small box in the same order that their corresponding cables are located on the crane girders.

Each plate is engraved with a number which is permanently duplicated on the fuses of its circuit, on its remote-control switch, conduit and skylight frame or floor-cable termination. Seventy-two No. 14 wires are carried in four conduits from this control box to the main switch box and furnish control-circuit connections to the remote-control switches and also supply current for the pilot or tell-tale lamp which accompanies each momentary-contact switch.

Advantages of System.

The whole system is designed to make as efficient as possible the various studio lighting operations and to yield the maximum of flexibility from the equipment installed. To the studio manager it presents the following very desirable features:

First, complete control of all lights, always located at the front of the set being photographed. This control is further of a nature suited to the character of the men who operate it, having no exposed current-carrying parts and requiring the manipulation of simple push-button switches only. It places the use of current under the direct supervision of the producer and director and makes it easy for either to economize on current.

Second, it provides for the safe moving, from set to set, of the whole lighting equipment except floor stands at one operation.

Third, it provides instant accessibility of current for all floor lights, and yet clears the floor entirely of all stage cables, which under other conditions may impede access to the set, are constant sources of danger due to the liability of actors tripping on them, and are subject to much depreciation when laid and dragged along the floor.

Fourth, it practically doubles the efficiency of the electrician in charge of the studio, as it releases him from having to remain beside a fixed switchboard awaiting orders to turn on or off the lights, and permits him to be actively employed in caring for the equipment while it is in operation, while eliminating the annoyance and uncertainty involved in the transmission of orders to him from the director, sometimes located at the other end of a busy and noisy studio.

Under operation this system is proving to be exceptionally free from trouble, although it has been used frequently by persons entirely without electrical training, and has been found to expedite greatly the studio work.

The system was designed and its installation supervised by the author, acting as consulting engineer for the owners. The electrical wiring and installation was done by the Pierce Electric Company, Chicago. The larger apparatus was supplied by the following firms: Mercury-vapor lamps, Cooper Hewitt Electric Company, Hoboken, N. J.; arc lamps, Chicago Stage Lighting Equipment Company, Chicago; motor-generator sets, Ideal Electric & Manufacturing Company, Mansfield, O.; motor-generator panel, Kohler Brothers, Chicago; remote-control switches, Palmer Electric & Manufacturing Company, Boston; cable connectors, Kliegl Brothers, New York; crane and ironwork, South Halsted Street Iron Works, Chicago; current collectors, Pawling & Harnischfeger Company, Milwaukee, Wis.

New York Telephone Situation to Be Investigated.—A report has recently been submitted to William A. Prendergast, comptroller of the city of New York, carrying out his request that a comprehensive analysis be made of the entire telephone situation in all the city departments, including the question of whether or not the city is receiving from the telephone and subway companies adequate duct space in the subway for the proper installation of its fire, police and other departmental wires and cables.

United States Radio Development.—A meeting of the Institute of Radio Engineers was held in New York on January 3 in the Engineering Societies Building, at which Robert H. Marriott presented a paper entitled "United States Radio Development." Mr. Marriott gave a rather complete history of the development of radio communication and of various allied subjects in the United States. The paper provoked considerable discussion.

The Detroit Edison Distribution System

A Brief Description of the Generating Equipment, and Feeder, Transmission and Distribution Systems, Together with Data on the Service Given by the Detroit Edison Company

THE extent to which a central-station company's service may be extended, not only in customers served, but in territory served, is exemplified by the Detroit Edison Company's system. Operating in a city which has the reputation of being the most prosperous of all our great American cities and which, with an unparalleled increase in population and industrial plants within recent years, entertains well-founded expectations of becoming the third city in size in the United States, the demand upon its generating equipment and distribution system has necessitated extensions that have taxed the company's facilities for making them. Keeping abreast of such a rapidly growing city involves extension problems of no small magnitude.

The residental service installations made during the past few years give an indication of the growth of the company's business. In 1912 there were about 10,000 installations, which has been increased steadily, until at the close of this year the figure has reached 20,000. The growth of the power business has been correspondingly rapid.

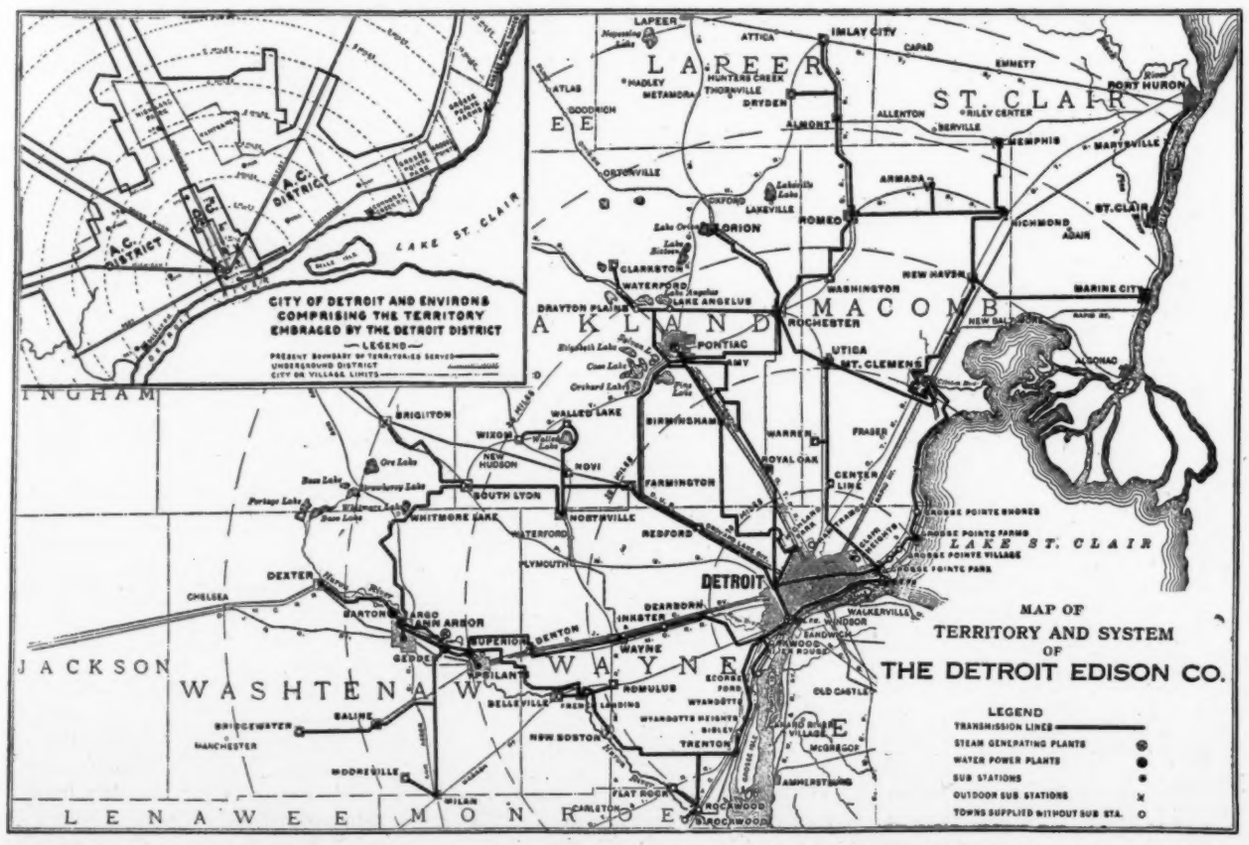
Despite the rapid increases in service provided in the city of Detroit alone, the extension of the company's lines to suburban territory has resulted in the building up of a distribution system which serves the major portion of the territory north and west of Detroit within a radius of 45 miles of the city. This system, including that part within the city of Detroit, is composed of over 1,600 miles of overhead transmission lines, supplemented by 119 miles of underground conduit, and forms a network which covers in a thorough manner the territory served. Extensions of the overhead transmission involved the installation of over 4,000 poles during 1915, the majority of these being 35 and 40-foot northern white-cedar poles with seven-inch tops, the remainder being longer poles of the same kind for special work. In 1916 over 5,000 poles were added to the system.

Generating Equipment.

The two most important power stations in the Detroit Edison Company's system are at Conners Creek and at Delray. The former is located on the Detroit River about four miles up river from the center of the city and in it are installed two 20,000-kilowatt steam-turbine units generating three-phase alternating current at 4,600 volts and 60 cycles. The Delray power houses, of which there are two, located about four miles down stream from the city, contain four 8,000-kilowatt, three 14,000-kilowatt and one 15,000 kilowatt steam-turbine units, which generate alternating current at the same voltage as those at Connors Creek.

The company also operates steam power plants at Mt. Clemens and Pontiac, Mich. The former plant contains one 500-kilowatt steam turbine unit, which generates three-phase alternating current at 2,300 volts, 60 cycles. The plant at Pontiac is leased. It contains two 600-kilowatt and one 100-kilowatt alternating-current generators direct-connected to Corliss engines. Generation is at 2,300 volts, three-phase, 60-cycle.

There are three hydroelectric plants, all located on the Huron River. The Argo plant is in the city of Ann Arbor and



Maps of the Detroit and Suburban Districts of the Detroit Edison Company, Showing the Extensive Distribution System, Which Serves a Great Part of Southeastern Michigan.

contains one 450-kilowatt, 650-volt, direct-current, vertical-type generator, and a 625-kilowatt, 2,300-volt, alternating-current, 60-cycle, three-phase, vertical-type generator. The Barton power house, two miles northwest of Ann Arbor, contains one 500-kilowatt and one 1,000-kilowatt, 2,300-volt, alternating-current, 60-cycle, three-phase, vertical-type generators. In the Superior plant, six miles southeast of Ann Arbor, there are installed one 250-kilowatt and one 450-kilowatt, 2,300-volt, alternating-current, 60-cycle, three-phase, vertical-type generators.

The total rated capacity of all the power plants is about 135,000 kilowatts. Several additions to the generating equipment are being made, chief among which is the installation of a 20,000-kilowatt turbogenerator in the Connors Creek plant. The company plans the erection of a third power house at Delray to contain four 50,000-kilowatt units, the first of which will be installed in 1917.

Substations.

The territory served by the Detroit Edison Company is divided into two parts—the Detroit district and the suburban district.

In the Detroit district there are 20 substations, including three remote-controlled automatic rotary stations. These substations contain converting machinery for feeding the street-railway system, the capacity being 15,500 kilowatts; and for feeding the downtown direct-current system, the capacity being 29,520 kilowatts. They also contain transformers for feeding the 2,300-volt lighting system and the 4,600-volt power system. Those for the lighting system have a capacity of 45,990 kilowatts, and those for power system 75,600 kilowatts. There are some power lines that are fed direct from the stations.

In the suburban territory there are 37 substations, including nine outdoor substations. These have a transformer capacity of 21,685 kilowatts, and contain converting units for feeding electric-railway lines, their capacity being 9,500 kilowatts.

The 57 substations are interconnected by a network of 4,600-volt and 23,000-volt trunk and tie lines, substantially as shown in the accompanying map of the company's system.

Distribution.

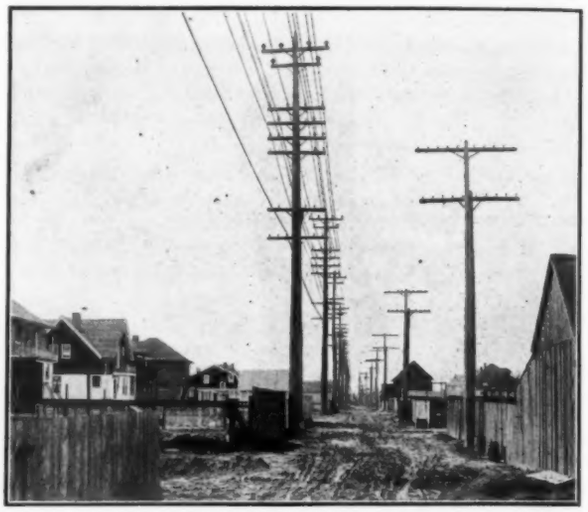
The city of Detroit is divided into two districts, one—the downtown section—being served with direct current, and the other—the remaining part of the city—being served with alternating current.

The direct-curent distribution system consists of a network of 120/240-volt, three-wire mains fed at numerous points by underground lines from the various substations scattered throughout what is called the direct-current district. A large part of the direct-current system is underground, since this district includes practically all of the central business section of the city, covering an area of nearly four square miles.

Direct current at 550 volts is also furnished to the Detroit United Railways through rotary converters or motor-generator sets.

The alternating-current distribution system consists of 2,300-volt lighting circuits, 4,600-volt power lines and a number of street-lighting circuits.

The Detroit district outside of the direct-current district is at present divided into 66 lighting districts, each fed from a 2,300-volt single-phase lighting circuit. The standard equipment for each lighting circuit consists of a 200,000-circular-mil, three-conductor cable (two conductors being in parallel) from the substation connecting with an overhead feeder of two No. 0000 B. & S. gauge wires. The feeder is run to a point near the center of a lighting district and is there tied to the network of primary mains. Transformers with a ratio of 2,200-127/254 volts are used to step down the voltage for secondary distribution. The secondary mains, wherever it is practicable, are banked in together in groups, including from two to ten, and sometimes more, transformers, to form the secondary network.



Transmission Line Leading from Highland Park Substation.
This line consists of two 2,300-volt circuits, two 4,600-volt power circuits, two 2,300-volt feeder circuits, one 2,300-volt tie line, one 110/220-volt lighting circuit, one arc lamp circuit, one ground wire, two telephone circuits and one 50,000-circular-coil wire. The poles are 60-foot northern white cedar, eight-inch tops, with four by five-inch, six-pin Washington fir crossarms. The poles are spaced approximately 120 feet apart. Th weight of wire per pole is about 1,604 pounds, the weight of crossarms, hardware and insulators 452 pounds, the total weight per pole being over 2,000 pounds.

While the 4,600-volt alternating-current power lines cover no definite territory, they are arranged as much as it is possible so that they may be divided up into smaller units as the demand for power increases in the different parts of the territory served. Due to the location of terminal railroads in belts around the city there has been a tendency to follow these railway lines with the heavier mains, with branches from them to the smaller consumers. Some of the larger customers pur-

STATISTICS ON THE DETROIT EDISON COMPANY'S DISTRIBUTION SYSTEM.

	Detroit District	Suburban District	Total System
Number of cedar poles	34,212	33,738	67,950
Miles of A. C. overhead distribution lines	3,422	1,894	5,316
Miles of D. C. overhead distribution lines	417	.....	417
Miles of overhead transmission lines	193	1,423	1,616
Number of arc and tungsten lamp street-lighting units	1,366	2,679	4,045
Number of ornamental poles	455	219	674
Conduit trench feet	628,344	950	629,294
Conduit duct feet	7,484,698	2,607	7,489,395
Number of manholes	2,368	7	2,375
Cable for distribution system:			
Miles of line	142	1	143
Miles of conductor	304	3	307
Miles of transmission cable	323	.....	323
Miles of transmission conductor	968	.....	968
Number of outdoor substations	.....	9	9
Transformers capacity of outdoor substations (kilowatts)	.....	875	875
Number of municipalities served:			
Cities	1	4	5
Incorporated villages	7	32	39
Unincorporated villages	.....	18	18
Townships	.....	6	6

Typical Examples of the Pole Lines of the Detroit Edison Company

Line of 45-Foot Northern White Cedar Poles on Livernois Road, Carrying Two 23,000-Volt, Three-Phase Circuits, Showing Line and Crossing Construction.

Looking North and South on Beaufait Avenue, Showing Line of 50-Foot Northern White Cedar Poles Carrying Two 4,600-Volt Three-Phase and Six 2,300-Volt Single-Phase Circuits, Secondary Circuit and Ground Wire.

In One of Detroit's Residential Districts—Kercheval Avenue Line of 50, 55 and 60-Foot Northern White Cedar Poles Carrying 4,600 and 2,300-Volt Primary Circuits and Various Secondary Wires.

chase the energy at the primary volatge and provide their own transformer equipment.

At present there are about 65 three-phase power lines, the standard equipment for which consists of a 200,000-circular-mil, three-conductor cable connecting to an overhead feeder of three No. 0000 wires, with smaller sized wire on the branch lines. Recently a number of new power lines have been installed, using a 450,000-circular-mil cable running entirely underground from the substation to the larger customers.

The company does no street lighting within the city limits, but furnishes service in practically all of the surrounding villages and townships. The standard for this service is a 6.6-ampere series circuit. For overhead construction No. 6 weatherproof wire is used and for underground systems No. 6 lead-covered cable, laid in an open trench, is used.

The distribution in the suburban district is effected by means of substations connected at convenient points to a 23,000-volt transmission network. From these substations the distribuiion is usually at 2,300 or 4,600 volts, three-phase, and where practicable several towns are served from the same substation. There are served in this suburban territory four cities, 32 incorporated and 18 unincorporarted villages and six townships.

We are indebted to H. A. Snow, chief clerk of the Statistical Department of the Detroit Edison Company, for much of the statistics given in regard to the company's system.

Overhead Conductors of Aluminum, Zinc, Iron.

The question of substitutes for copper as material for electric conductors is seriously exercising countries like Switzerland, which stand outside the war, and which, one might think, have in their own aluminum a good substitute. The Neuhausen aluminum works, near Schaffhausen, are on Swiss territory, it will be remembered. But there is a general dearth of raw materials for aluminum manufacture, and so far very little aluminum has been used for conductors in Switzerland. The Swiss Elektrotechnische Verein discussed the problems last spring in connection with reports and papers by Professor Wyssling, A. Burri, and others. Taking the conductivity of electrolytic copper as 100, those of aluminum, zinc and iron are 58.4, 28.5, 12.5, and the temperature cofficients of the four metals 0.0043, 0.0042, 0.0039, 0.0053. Thus aluminum might well compete with copper, and as long as its price is 1.89 times that of copper it would be the cheaper conductor, acording to Wyssling. There are mechanical difficulties, of course, but they have been overcome.

As regards zinc, wire was hardly used until a few years ago, and zinc wire is not so reliable as iron wire. There may be hollows and brittle portions in an apparently uniform zinc wire, and the wire should in its making not be heated up to 100 degrees centigrade for long periods, lest its strength and pliability suffer. Really hot steam is directly dangerous to zinc and zinc wires should not be suspended in damp, hot atmospheres. On the whole, the metal can hardly be recommended for overhead lines. It may be used when properly protected, however, and bus bars of zinc are feasible; they should be guarded against damp contact with other metals, and be covered with varnish in such cases. To a certain extent zinc wire is used in distribution cables by German electricians at preser.t.

The objection to iron wire is not so much the low conductivity itself as the fact that the resistance to alternating currents is, owing to the skin effect, influenced by the current and frequency. W. Peukert and other German electricians have again investigated these features. Peukert tried various frequencies up to 300 cycles per second. The voltage drop and energy consumption were greater on alternating-current circuits than on continuous-current circuits, of course. On 60-cycle circuits of 9.6 amperes a conductor consisting of seven strands of iron wire, each 0.67 millimeter in diameter, showed an increased voltage drop of 5.4 per cent, and an increased energy consumption of 4.9 per cent. The Verband Deutscher Elektrotechniker issued last year regulations concerning the use of iron wires as conductors for alternating currents. Such wires are not to be made in sizes exceeding 2.5 square millimeters in cross-section. Larger conductors should be made up of at least seven strands of wires, 1.4 millimeters in diameter, these wires to be provided with paper insulation within an iron, lead-covered sheath. This style of wire is designated "M. P." wire, and is recommended only for low-tension and dry localities; on polyphase circuits the sheath may serve as the neutral wire.

In Switzerland galvanized-iron wire is recommended for high-tension lines, at any rate for short sections. Burri has compiled tables for their installation. For house installations in particular the use of iron wire, advocated in Germany, seems quite justified; matters were different in the early days, when something over four watts was required per candlepower in the old carbon-filament incandescent lamps. The general use of tungsten lamps does not call for such high conductivity.

Officers' Names and Salaries Exhibited in Boston Lighting Case.

Despite objection on the part of higher officials of the Boston Edison Company, the Gas and Electric Light Commissioners' demand for the company's "special pay roll," with the names and salaries of the officials, prevailed, and these were included in the published exhibits, in connection with the Boston street-lighting case now going forward before the Board. President Charles L. Edgar, protesting, expressed opinion that by publicly exhibiting the names with salaries a demand might arise for larger compensations from those who regarded themselves as less fairly rewarded than others, and this would be contrary to public interest.

The list includes 46 officials, with salaries aggregating $273,564. The president and general manager receives $40,000 per annum; the vice-president, $5,000; treasurer, $10,000; general superintendent, $14,740; purchasing agent, $6,975; superintendent of construction, $8,999; assistant superintendent of construction, $9,000; auditor, $6,000; superintendent welfare bureau, $5,624; superintendent station engineering, $8,999; superintendent of electrical engineering, $7,500; superintendent of generating department, $9,100; chief engineer, $5,000; superintendent of special research, $8,000; assistant to general superintendent, $10,400; superintendent of sales department, $6,000; superintendent statistical bureau, $7,000.

The special pay roll is kept at the company's executive office on State Street, while the general pay roll is kept at the business offices on Boylston Street. Heretofore only one or two men knew the figures.

Corporation Counsel Sullivan, in charge of the lighting contract case for the city of Boston, suggested that the names and salaries be referred to by number only, but it was decided to put the full data in evidence.

Congress Considers Bills for Diverting More Water from Niagara Falls.

Resolutions authorizing temporary additional diversion of water from the Niagara River to a maximum of 20,000 cubic feet per second to meet the electric power shortage on the American side were favorably reported in the Senate and the House last week.

The Senate resolution, which originated with Senator Wadsworth, of New York, has the approval of the War Department and would permit until July 1 the diversion of 20,000 cubic feet per second. The limit permitted now is 15,600. The House resolution is substantially the same as that passed by the Senate, except that it would remain in force only until March 4.

The Results of Indifference to the Public

By GLENN MARSTON

This is the fourth of a series of articles by Mr. Marston dealing with municipal-ownership problems for the central station. Causes and results of indifference to the public, as investigated in several communities, are discussed. Previous articles have discussed "Politics and the Central-Station Company," "Guarding Against Municipal-Plant Agitation," and "Poor Service Causes Municipal Ownership." Another article will be published in an early issue.

IT seems unbelievable that indifference to public needs should be a frequent cause for municipal-ownership agitations, yet I have found a number of cases where the company's unpopularity has been largely traceable to this serious shortcoming. It is obvious that indifference will breed dislike, and a consequent slowing up of business expansion, yet there have been a number of companies which have been so well satisfied with the way things were going that they paid little or no attention to the changing needs of the public.

Indifference is generally found in companies which feel themselves thoroughly intrenched against the entrance of another company giving the same service, in companies which have been under a single management for a considerable length of time, where the early growth of the company was rapid and easy, and where the population is of a naturally conservative frame of mind. For a time it existed in some of the middle-sized towns of the North and West, but the spirit of indifference in that part of the country seems to have been replaced by a decidedly aggressive public spirit.

The public seems willing to stand indifference about so long, and then there comes a strong reaction, which is extremely hard to handle because it is so well justified. The best that can be done is a promise to be good in the future, but such promises are taken with suspicion, and do not always gain acceptance by the public. When a company has failed to do its duty fully for a considerable length of time, the people can see no reason why they should accept a sudden reformation.

The Evils of Indifference.

The cure suggested for indifference is usually the introduction of another plant, either municipal or private. The people set out to "get" the company, and real and fancied grievances become so involved with one another as to be indistinguishable. A woman cannot lose her good name half as quickly as a company can, and once the "panning" begins, there is no telling where it will stop. When the public becomes aroused against a company, the universal desire seems to be to punish the company, no matter what it may cost the community. It is not a fitting time to discuss economic theories on the ultimate losses through competition and the endangering of fixed investments. Many a company would be lynched after a prolonged period of indifference if the people thought it had soul enough to destroy.

Such companies, fortunately, are growing fewer and fewer. The last ten years has seen a remarkable change in the attitude of corporations toward the public, and that change is nowhere more apparent than in the electric industry. There is always the possibility, however, that a self-satisfied management may become lax in its attentions to public needs, and it behooves every company to keep a lookout for the first indications of over-complaisance among its employees. There is probably nothing which will so quickly and deeply anger a patron as the feeling that the company is indifferent to his needs.

The Result of a Competitive Situation.

Not infrequently the accusation of indifference against a company is coupled with the charging of high rates on antiquated rate systems. Then, indeed, is unravelling the snarl a long-drawn and difficult process, ending nearly always in a readjustment of rates. Hardly ever is indifference unconnected with some other well-defined and reasonable cause for discontent. This is, of course, natural, for a management which fails in this all-important direction can be expected to fall short in other ways also.

One of the most difficult cases of indifference which I have seen occurred several years ago, and the situation has not been entirely cleared up yet, though the company is making steady improvement all the time. The city had a good water department, which made the position of the company all the worse, for comparisons were frequently made between what the water department was doing and what the lighting company was not doing.

There had at one time been electric competition of a very bad kind in this city, and the elimination of this competition was a matter of great satisfaction to the entire community. The company started out well liked. In order to secure consolidation, the company had told of a very rosy future in store for everybody concerned, company and public alike. Unfortunately the rosy part did not materialize, except temporarily, perhaps, for the stockholders. The competing properties were not in good condition, but all the new company did was to eliminate duplications and go on with the same old distribution systems. The city was overwired, so it was not necessary to make any extensions for a long time. When the time did come for extensions the management did not make them. Its attitude was that it had gotten along for years without any, and could get along for a while longer. The existing business, it said, was satisfactory, and it would have to increase the density on existing lines before it could consider extensions.

The company, at the consolidation, had also accepted a rate schedule which, at the time, was fair enough, but which finally grew to appear very high in comparison with neighboring rates. No attention was paid to complaints of excessive or unfair rates, and this was allowed to become a very sore point with the small consumers, who were, of course, in the majority.

There were frequent interruptions, and these were never explained, unless by saying that some of the property of one of the original companies had proved defective. This was most assuredly true, for there was no other property to become defective. Depreciation of this originally cheap construction, and the increasing loads on it made interruptions seem the only logical result. When the 10-year street-lighting contract was about to expire, the street-lighting service was not well maintained, and it was then that somebody suggested municipal ownership as a means of getting revenge on the company. The idea spread like wildfire. In six weeks an election had been held and the plant voted for. The company began reconstructing its lines; it ordered new equipment; it offered to submit the rate question to the state commission; it became very, very good. It was too late.

Ignoring Complaints Led to an Agitation.

The municipal plant has not been built, because there have been some delays in perfecting the bond issue. The company was popularly believed to be behind some litigation which involved the proposed plant and which delayed starting it. This has a tendency to further unpopularize the company; but in the meantime it is making every effort to merit public esteem in other directions, and is really doing so. It is making progress toward getting back into the good graces of the people. Perhaps—probably, in fact—by the time the authority to construct a municipal plant is decided the people will feel that they do

not need it, for they were easily convinced from the beginning that it would not be a financially profitable venture. They were simply so exasperated with the indifference of the company that they felt it must be punished. The vote was not for municipal ownership, it was against the company.

Another case, which was at the time widely discussed throughout the industry, was of a company which ignored all complaints, official or otherwise, and which finally had a radical rate ordinance passed by its city council. The company got into a rather desperate situation, but it did not take any steps to win for itself any favorable public sentiment. Such publicity as it secured had to be devoted to defensive measures, and the case was so complicated by various elements that a defense in words of one syllable was practically impossible. In fact, the defense was not accepted by either courts or commission, which made the public feel that it had been still further abused. There was constant agitation for a municipal plant, which was held off for some time, while the company made strenuous efforts to set itself right with its patrons. These efforts were successful, for the vote was against municipal ownership, yet how much better it would have been for all concerned if the company had adopted a conciliatory attitude in the beginning, instead of one of defiance, which cost it thousands upon thousands, cost the city other thousands, and resulted finally in a general readjustment of the relations between the copmany and the city. The money spent on precarious litigation would have been saved to the customers, and the company might have arrived at a better settlement than it was finally forced to accept.

Example of Indifference in a Southern City.

In a Southern town of some 10,000 population I was sent to alleviate the perils of a combined water and light company which had become very unpopular. The cause was indifference, and I could easily understand how this state of indifference had come about. It was one of those places which had become stagnant. The secretary of the Chamber of Commerce told me that the entire population was "cursed with contentment" and this applied also to the water and light company. The property was distantly related to the "one-hoss shay," for after it had been built, it was apparently expected to run on and on until it fell apart.

The trouble started, perhaps, through the development of some water powers not many miles away. These were being used for industrial development in neighboring towns. This town began to feel neglected, and wanted its company to do what was being done elsewhere. The company was satisfied to leave things as they were. The town decided that it would make the company wake up or sell out. There was some very bitter feeling, so bitter that the town would not build a sewer system—though the money had been voted some years before—because it would increase the revenue of the water company.

In still another town, in New England, the company relied on the inherent conservatism of the population to be satisfied with things as they always had been. They ignored complaints, and failed to improve service. The indifference to the public was only equalled by the indifference to the lighting system. When the uprising came there was no preparation to meet it. It was a situation full of queer phenomena. For several weeks the company's few friends worked their best to show that municipal ownership would not be a solution of the difficulty. There seemed to be no headway. The whole town was talking municipal ownership. And suddenly the whole town got tired of it, and it has never come up again to this day. It was not a question of convincing the leaders, for the rank and file of the community were sober, self-thinking people. The efforts of the company's friends had been effective, though no sign had been shown of it until these sober people had weighed the question in their own minds and all come to the same conclusion almost simultaneously.

Indifference alone was the cause of a great deal of trouble to one company in a fairly large city. There was no complaint of the rates, for they were unusually low. The service was good, though subject to some interruption through long transmission. The company had an aggressive new-business organization, which was successful on account of the low rates it could quote, yet it seemed as if that company had hardly a friend in the city. The reason was simply its indifference. It felt it was giving good service, it knew it was giving low rates, and it thought that more was unnecessary. The manager was seldom to be seen, and there was much routine in handling complaints. There seemed to be every reason why the company should have been exceedingly popular. Unquestionably its power rates had been a factor in the industrial prominence of the place. Yet it was nearly friendless.

The Need of Personality in a Company.

It came nearer being the soulless corporation than any other company I have seen. It was painfully efficient. The people never realized what the city owed to that company, because the company had not taken the trouble to tell about it. To be sure, at the annual Chamber of Commerce banquet some one would get up and tell about "our cheap and inexhaustible water power, God's gift to Ecksville" but that would be all until next year. And the people got to feeling that maybe, after all, the company which had ventured its money to bring that power to Ecksville had taken unto itself God's gift to the community. It was a simple matter for some one to suggest that the people take possession of this gift, instead of letting the company have it. And then on every street corner one heard iniquitous tales about the company. Every citizen had a personal unpleasant experience to relate, all because the company, instead of the city, furnished the power. They must vote for municipal ownership; and they did. All the efforts of the company, in the few short weeks it had in which to work, were unavailing, though it gained friends every day.

In another article I have referred to the need of personality in a company. That is something this company did not have; and it was this lack which made the resistance against municipal ownership so difficult. As far as the public was concerned there seemed, in this company, to be no responsible person whom it could reach with its troubles. They had to be told to young clerks who were not qualified to handle complaints with the discretion they frequently need. If the underlying did not give satisfaction the customer had no recourse. The company had no personality, no soul. It was a machine which took your money and gave you neither satisfaction nor thanks. And it was a monopoly, a huge, indifferent corporation.

Indifference is an insidious evil. It is not easy for a manager to tell whether he is becoming indifferent to the attitude of the public. Running a public utility becomes more or less a habit, just as everything else does, and it takes constant watchfulness to keep from assuming that just because a certain condition has existed, it should continue to exist. Communities change, and they expect their components to change with them. When a public utility changes, it should change for the better, and waste no time in telling the community about it.

National Foreign Trade Council to Convene.

The fourth convention of the National Foreign Trade Council will be held at the William Penn Hotel, Pittsburgh, Pa., January 25-27, at which the following questions will be considered: Conditions in foreign markets after the war, and the measures necessary to safeguard American foreign trade, as well as the foreign trade aspect of the American tariff system; co-operation in foreign trade development; the American merchant marine; foreign investment of American capital as an aid to oversea commerce; problems of the smaller manufacturer and merchant. All Americans engaged in or desirous of entering oversea commerce, and particularly all Boards of Trade, Chambers of Commerce and other commercial and industrial organizations, have been invited to participate. R. H. Patchin, Hanover Square, New York City, is secretary of the Council.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

TRIAL MOTOR INSTALLATIONS FOUND NECESSARY.

Practice of the Illinois Northern Utilities Company in Securing Difficult Power Business.

Commenting on the value of trial motor installations in influencing power business where there is a doubt in the mind of the prospect as to the results that might be expected, Charles B. Yonts, general contract agent of the Illinois Northern Utilities Company, makes the appended statement.

We have made a number of trial motor installations. In fact, it is the only way we could get the business in a number of cases. We serve 14 counties in Northern Illinois in which the principal industry is dairy farming and we therefore have a number of grist mills and elevators on our lines, operated by co-operative companies in a number of cases.

We serve 63 cities and villages and do most of the water pumping in these communities. All of these have required trial installations on account of having so many to please and their ignorance of electric-motor operation. Our transportation facilities were poor and it took a lot of time in getting around to sign every one. We found that trial installations reduced our selling cost to a minimum.

We have followed no particular plan, every trial installation requiring special attention. We have put in large motors as well as small ones on trial, having had one installation which required a 75-horsepower motor. We of course had the co-operation of the manufacturer on this particular job and they loaned us the motor; however, this was done two or three years ago. I do not think we could arrange this again, due to the present tieup on delivery of equipment.

Some of the trial installations we have made are very interesting and I am sure we never would have closed a number of them had we not offered a trial. In fact, we have stumbled onto a lot of business in the grist mills through trial installations, making belt-connected installations to the old line shaft where they were using oil or steam engines. Later on we replaced the belt connection with direct-connected shaft, reducing the operating cost one-half.

It seems the smaller the town and the smaller the installation the less the operator knows regarding electric drive. In larger plants where they are well acquainted with the efficiency of operation and flexibility of service with electric motors as compared with shaft drive, the less need we have for trial installations.

We have taken over the greater part of the power business in the smaller towns and the few that are left are very hard to close. The majority of the jobs being closed at the present time necessitate trial installations.

We not only favor trial installations but think it necessary to get the business quickly and to reduce the cost of getting it. Up to the present time we have never had a trial job come back.

Direct Returns from Wichita's Electrical Week Celebration.

In a report submitted by the committee in charge of America's Electrical Week celebration held in Wichita, Kans., it was stated that as a result of a 10-per-cent discount adopted by all dealers in electrical devices during the week, over 200 electrical household appliances were sold, having a total selling value of over $2,200. There were in addition 51 contracts secured for the wiring of old houses. This campaign featured a free wiring and fixture installation, a coupon being given to the customer after signing a contract.

Minneapolis Company Serves 32,000 Residential Customers.

The latest statistics supplied by the Minneapolis General Electric Company, Minneapolis, Minn., show that the company is now supplying 32,000 residential customers. As the present population of the city is 363,000, the percentage of customers supplied to the total population is 8.8 per cent.

In a table published in our issue of December 23, giving similar percentages for cities having a population of over 100,000, it was erroneously stated that the population of Minneapolis was 500,000 and that the percentage of residence customers to the total population served by the company was therefore six per cent.

Selling Electric Irons in Off Season.

While electric irons are sold all the year round, it is generally recognized that the hot summer time is the best time of the year in which to push the sale of this appliance.

As an inducement during America's Electrical Week the Texas Power & Light Company offered a one-week special to all customers, this special consisting of a guaranteed General Electric six-pound iron at a cash price of $2.50. As a result of the offer 523 irons were disposed.

The sale was advertised by means of a sticker attached to the bills sent out on December 1 and by means of newspaper advertising. One of the stickers is shown in the accompanying illustration.

An interesting feature of the sale was the offer made to non-commercial employees of the company of a free iron to any employee who would sell 10 or more irons at the special price during the week. Thirteen employees recieved a free iron in this connection.

The demand for irons during the two weeks following the sale was also greatly stimulated.

ONE WEEK SALE
$3.50 Irons for $2.50
During the week of Dec. 2nd to 9th only we will sell, at our office, for CASH, standard, guaranteed General Electric $3.50 electric irons for $2.50.
This is a fine chance to buy the iron you have been wanting for yourself or one for a Christmas present for one of your friends.
December 2 to 9 Only

Inclosure Sent Out with Monthly Bills by the Texas Power & Light Company in Special Iron Sale.

SECURING THE SMALL STORE CUSTOMER.

Some Interesting Statistics on the Edison Electric Illuminating Company's Efforts.

In every large city there are hundreds of small stores and shops,—barbers, grocery and provision stores, plumbers, undertakers, bootblacks, bakeries, tailors, real estate offices, small dry goods stores, etc. Most of these small business men do not own the property they occupy. They pay rent. Frequently they would gladly use electricity but the initial outlay, together with the fact that it means improving somebody else's building, is too much. It scared the small storekeeper and made him hard to secure. This condition was met by applying the idea of the house-wiring scheme.

The salesman was enabled to go to the small store man and say, for instance, we will find a contractor who will wire up your store complete for $30 and do a first-class job; all you need to do is to pay $2 down and the rest at $2 a month without any interest charges. That sounds reasonable to most men. An immediate payment of $30 on completion of work would be prohibitive. The underlying principle of the small immediate payment with easy payments to follow is so self-evident it needs no elucidation.

The Boston Edison plan for store wiring was put into effect December 1, 1913, and has been in use ever since. During this time 3,104 small stores were wired, an average of 97 per month; the load connected, 2,360,109 watts or 2,360.1 kilowatts; or 47,202 50-watt equivalents. The wiring as contracted for cost $85,587.77 and the estimated annual income is $154,506. The income for one year is thus estimated at about double the cost of the wiring. On these contracts, $9,857.25 was paid down and the monthly payments are $6,857.65.

The estimated income of approximately $155,000 per year is modest, only about $50 per year, a little over $4 a month from each store. They actually run considerably higher. An analysis of the income from 200 of these customers, taken at random, showed an annual income from each of $62.50. On this basis, the 3,104 stores mean an estimated annual income of $194,000. When the additional fact is stated that the average cost to wire the store was but $27.57, it is evident how desirable this small store business is.

To get this business the co-operation of the credit department is necessary. Take the barber, or baker, or fruit man, in fact any of this class of business, to get him to agree to change is no small job, and if thereupon the credit man holds up the contract for $10 or more deposit, it means, "nothing doing." The credit department must take chances and forget the Almighty Dun and Bradstreet ratings and proceed on the good, old-fashioned principle that most men, even if they have unpronounceable names, are honest. This faith in humanity has not been misplaced. It has been checked up. Out of the group of 200 customers before mentioned, just 14 were discontinued and out of these 14, four paid all wiring and current bills. That left but ten "lame ducks" out of 200. The loss on the wiring was $151; the loss in current supplied, $54.48, a total loss of $205.48. In per cent the loss on the wiring was 2.8; on the current eight-tenths of 1 per cent.

Applying these percentages of loss to the 3,104 customers secured under the plan, there is a loss of $2,396.46 on the $85,587.77 cost of wiring; and a loss of $845.53 in current supplied. Total estimated loss, $3,241.99. Spreading this total estimated wiring and current loss over the 3,104 customers, there is an apparent loss of $1.04 per customer, for an average annual income of $62.50 per customer.

To prove these percentages an additional 200 were taken at random. The figures checked almost to the cent. In this connection is must be added that where the company has taken a loss, it has an asset in wired premises that will make almost certain a succeeding customer.

In addition to financing, the company has loaned fixtures to the small store man as a special inducement. A plain Mazda fixture, chain stem, with Holophane shade, for interior lighting, for units of 100 watts and up; an outside, inclosed lamp for units of 150 to 500 watts. Up to August 1, 1916, 23,324 interior fixtures were put out and 4,260 exterior ones. At $2.75 for interior and $4.25 for exterior fixtures, this represents an investment of $82,246. It cannot wholly be charged to store wiring, however, as fixtures were loaned to all stores that would displace gas. It is estimated that 50 per cent of these fixtures went into installations, where the owner or storekeeper was already using electricity, but only using it as auxiliary to gas, or where the owner financed his own wiring. That leaves $41,123 for fixtures chargeable to the store-wiring plan.

As the wiring of the stores is paid for practically in full by the customers at the end of 15 to 20 months, this $41,123 plus the loss on wiring and in current, plus the interest charges to finance the wiring, is thus the total expense to the company. Allowing, say, 5 per cent for interest, we have

Interest, 5 per cent on $85,587.77	$4,279.39
Loss on wiring and current	3,241.99
	$7,521.38

That means $2.42 per customer. If we add the cost of the fixtures, the total is $48,644.38, or $15.67 per customer. Look at it either with or without the cost of the fixtures, this expenditure to secure an annual income of approximately $200,000 is small. When one considers that the fixtures are really the company's property and are merely loaned as long as Edison service is used, and that practically all this business was secured by the regular solicitors, the expense becomes insignificant when measured with the results. On September 1, 1916, the company stopped loaning fixtures, primarily for the reason that the manufacturer put up the price 50 per cent.

The store-wiring plan, with the house wiring, has become a permanent feature of Boston Edison sales equipment—permanent at least until such time when there will be no other forms of illuminant to displace. It is not unreasonable to say that most of the 3,104 stores, which mean approximately $200,000 per year to the company and which were 11 per cent of the total number of customers connected during the 32 months up to August 1, 1916, would still be using gas if it were not for the store-wiring plan.

Bakers Appreciate the Value of Odorless Electric Vehicles.

During an electric-vehicle campaign conducted in 1915, Von Thun Brothers, bakers in Brooklyn, N. Y., ordered one electric truck through the Edison Electric Illuminating Company of Brooklyn, and at the same time purchased a horse for $300. The electric proved to be so dependable and satisfactory in every way that they sold the horse for $100 and purchased two more electrics and are now contemplating buying a third.

The electric vehicle is gaining great favor in the baking industry, as it is not only more economical than the gasoline car, but is devoid of the fumes of burned gasoline which are so undesirable, since odors are so readily absorbed by pastry. The advertising value of the clean silent electric is also considered an important feature as evidenced by the stress laid by one of the largest bakers in the country on its fleet of several hundred attractive, dependable electrics. In modern bakeries where scientific methods are employed, electric vehicles furnish a valuable link between the consumer and the producer, and many baking companies which have eliminated the use of horses and purchased electric delivery cars, credit a large percentage of their new and increased business to this new factor. The Electric Vehicle Section, National Electric Light Association, has record of more than 50 bakers who are now operating electric delivery cars, according to the secretary.

HOW TO SELECT NEWSPAPER SPACE.

Suggestions for Advertising Departments of Central Stations Offered by J. C. McQuiston.

Considering the comparative worth of newspapers as advertising mediums for central stations, the advocates for morning papers base their claims on the following:

(1) Every man in any household of standing in a commercial or professional way in the community picks up his paper at the first leisure moment in the morning. This is a fact so well known that it is a common subject for jokes. You need to look about well among your friends of means and consequence to find a man who does not either at home or on the way to the office read the morning paper. This being the case, the paper to be successful must appeal, as it does, to the better class of people.

(2) The policy of the morning paper is generally to build up, not to tear down.

(3) No good morning paper runs scare head-lines and unreadable stories concerning scandals, crime, etc.

The central station will find the morning paper particularly adapted to the advertising of commercial applications for electricity and will find its advertising of considerable value in maintaining the good will of the community. If the central station retains the good will of the influential classes the masses are likely to follow.

The following facts concerning evening papers should be considered:

Evening Papers.

(1) They reach the masses and have a larger circulation than morning papers.

(2) Where the carrier system prevails they are more thoroughly read in the home than morning papers.

(3) More women read evening papers than morning papers.

(4) Contain less fresh news and much re-hashing of news from the morning papers.

(5) Have more features, such as funny cartoons, colored headlines and sensations.

Policy advertising, advertising for the wiring of existing buildings, and advertising done to increase the use of electric light and the better known electrical devices, such as flat-irons, vacuum cleaners, etc., can be done more efficiently in the evening papers than in the morning papers in most communities. Special campaigns for the introduction of cooking devices, Christmas campaigns and the selling of electrical Christmas presents can probably best be concentrated in the good evening and Sunday papers.

Sunday Papers.

In balancing the Sunday papers against the daily papers the smaller central station should consider the following points:

(1) Rate per line per thousand of circulation averages 30 per cent less than in the morning papers, and 20 per cent less than in the evening papers.

(2) The readers of the Sunday paper have leisure to go over all of the pages and read advertisements as well as the text matter. However, such a volume of matter is contained in the average Sunday paper that much of the advertising is overlooked.

(3) The Sunday paper goes to the home.

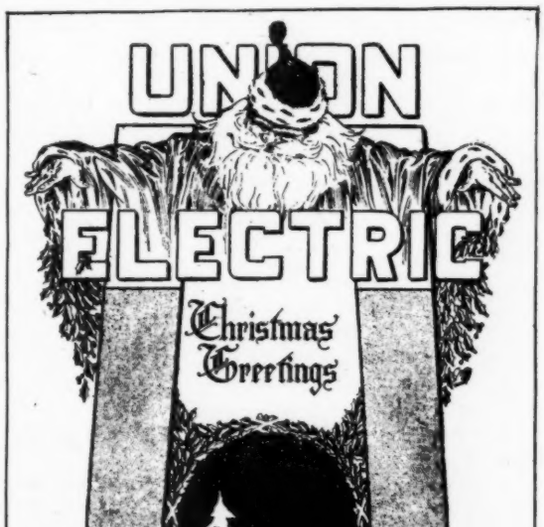
(4) The Sunday papers are more willing to print stories regarding electricity and its applications; also to show up developments in the local central-station plant.

All the foregoing considerations show that experience and good judgment are required to get the best results out of an advertising appropriation. Every plant cannot afford an advertising department; the majority cannot, but there should be appointed some one individual in every central-station company—one man who is to have charge of and be responsible for the advertising. He need not necessarily devote all his time to it, but it should be conducted on a serious business-like basis. If the authority and the responsibility are delegated, the advertising will show results.

The advertising man should be of the same general type as a manager. His literary abilities while valuable are perhaps the least important of his qualifications. He should, next to the manager, be the progressive element, the promoter, the "live-wire" in the affairs of the company and in the community. Tactful and diplomatic he must be, to prove efficient in dealing with the press and the public through the press. It has been customary to consider the advertising as an activity of minor importance not requiring serious thought, but such a feeling should be dispelled; advertising and selling are equally as important to the earnings of the central station as engineering and operation. It is the increased load produced by the advertising and selling departments that really pays the dividends. The relation between the advertising and the selling should be one of the most intimate co-operation.

Christmas Advertising of St. Louis Company.

The accompanying illustration shows a very simple yet attractive Christmas card which the Union Electric Light & Power Company, of St. Louis, Mo., published in the newspapers on Christmas day. The company's well known trade



Christmas Greeting of the St. Louis Company Which Appeared in Morning Papers on Christmas Day.

mark was somewhat modified to carry out the Christmas idea. The company received many compliments on this evidence of its good will towards the public.

Christmas Celebration of St. Louis Company.—The Union Electric Light & Power Company of St. Louis on December 22 held its annual Christmas celebration, given to its employees, at the company's garage, Twentieth and Locust Streets. Music was furnished by the Union Electric Orchestra, consisting of 18 pieces. The children's celebration was in charge of the Normal Play Directors of Lenox Hall.

ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Laying Out Panelboards.

By Harry B. Stillman.

The laying out of panelboards resembles in many ways the laying out of switchboards, which was described in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of December 30, 1916. Usually panelboards are much simpler than switchboards. However, there are some suggestions along this line that may prove of value, especially since neglect of them so commonly causes trouble.

Slate that is to be used for panelboards should be examined closely for cracks or other defects before being laid out. Small cracks or seams may appear as a trivial matter perhaps, but under certain conditions, such as extreme heat or rough handling, are likely to increase or spread rapidly, like the measles in an orphan asylum. It is rather discouraging to the man who foots the bills to discover, as the drilling is nearly completed, that a small seam has developed into a full-grown crack, being increased or opened up by the drilling.

These cracks may usually be located at the start by applying a damp cloth or waste to the slate; the dampness soon dries off from the surface of the slate, with the exception of the cracks, which hold the moisture for a longer period, and show up as thin dark lines. Another method is to strike the slate a light blow with the hammer; an experienced man can quickly tell by the ring of the slate whether it is cracked or not.

The method to employ in laying out slate depends considerably upon the size of the job in question. The smaller jobs, consisting of a few panels only, and all straight work may be laid out or marked off directly on the slate. The larger and more complicated job, however, is a horse of another color, and should be handled in a more systematic manner.

Guesswork in panelboard construction is mighty poor policy. Putting the job through on the hit-or-miss fashion, trusting to Providence and your star of fortune that everything will turn out all right, is apt to prove in the end that Providence and your own particular star of luck did not seem to be on speaking terms.

If there are many panelboards of various designs to be laid out, making first a paper template for each design will give better results. Laying out the drilling dimensions for complicated panels directly on the slate is apt to increase the possibilities of mistakes and skipped holes, as the numerous pencil lines required for marking out the complex designs are very likely to be rubbed or blotted out by slate dust when drilling.

There should be a template for each design of panel. This same template may be used for all the panels on the job of the same construction, providing they are all of the same width. For instance, if there are to be 24, 18, 16, and 12-circuit panels, all with 100-ampere mains, by making the template for the 24-circuit board it may also be used for each of the small panels, by placing the top or bottom of the template (whichever way the mains are to enter) even with the edge of the slate and letting the unused portion hang over, as shown in Fig. 1.

The templates should be lined off or laid out with T-square and rule, with the full-size spacing or measurement of each hole to be drilled, Fig. 2.

The top, the size holes, job number, customer's name, in fact, any necessary data or descriptive captions, should be plainly marked on each template, as all this information may come in mighty handy at a later period, should any question arise as to the construction of a certain panel. Instead of an enforced journey of many miles to where the panels were installed to verify a few facts or points that you may be a little hazy on, you will have the facts in black and white on the templates right at home.

When the drafting of the templates is completed they should be laid on the slate, the sides even all around, and center-punched, as described in the article published December 30, 1916, on laying out switchboards. Right here a word of caution is advisable to the man who wields the center-punch. Undoubtedly over 70 per cent. of poor drilling, such as rows of straggling holes, that are away off center on all points of the compass, could have been nipped in the bud if the operator had watched the entire position of the center-punch, instead of only the point, just as he was about to strike. The usual practice results in the tool being held at a greater or less angle, and it needs but the blow of the hammer to drive the tool away off center. See Fig. 3.

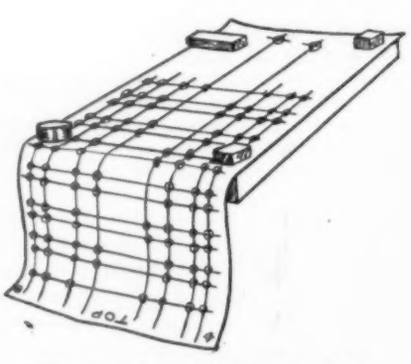


Fig. 1.—Using 14-Circuit Template for Six-Circuit Panel.

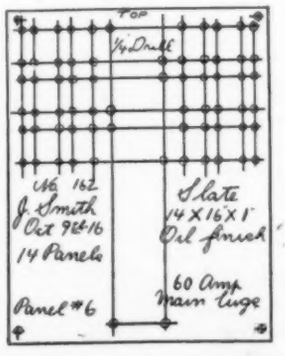


Fig. 2.—Typical Layout for Six-Circuit Template.

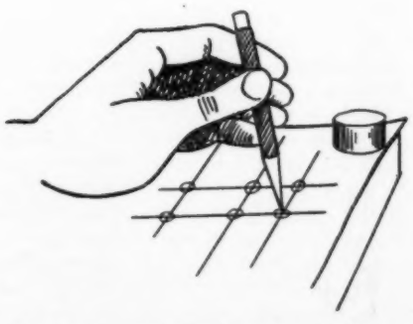


Fig. 3.—Incorrect Position for Holding Center-Punch.

Good habits are as easy to acquire as bad ones. A little practice in the art of holding the tool straight would soon form as natural a habit as slipping a certain arm into the coat sleeve first.

The panels should be numbered in rotation; if there are

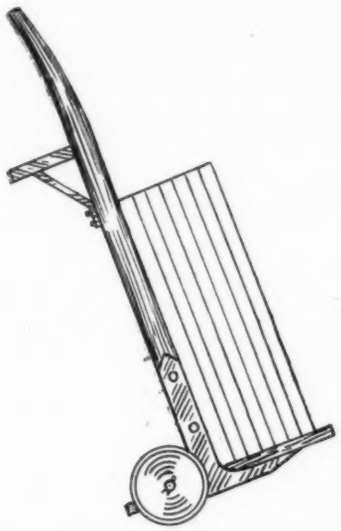


Fig. 4.—Convenient Method of Carrying Panels.

slate door or side linings, these should be numbered after being fitted to the panels, so as to correspond with the panels they are to inclose. Slate varies considerably in size. It is not an unusual occurrence to find slate to run from one-sixteenth to one-fourth of an inch either under or over size. To try and set in a side lining around a panel 18.25 inches wide which had been correctly fitted to a panel 17.75 inches wide, would be like trying to put a No. 6 shoe around a No. 8 foot; to say the least, it would mean a strenuous amount of labor in both cases. Numbering each panel with linings to correspond will usually prevent such trouble.

After being laid out, the slate should be placed in a convenient location for the next operation, bearing in mind that slate is slate, neither luggage nor a bale of hay, and

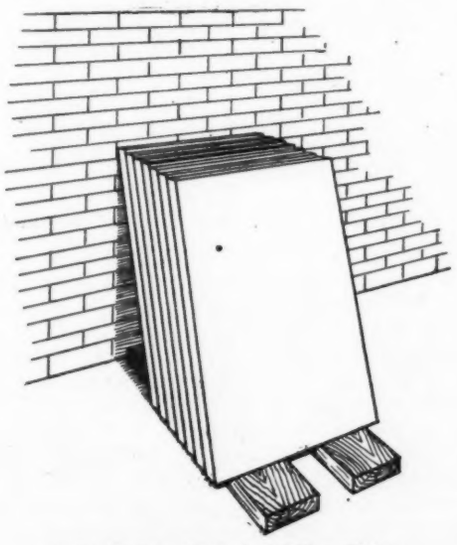


Fig. 5.—Safe Method of Piling Slate.

should be handled carefully. A little judgment displayed in this respect would undoubtedly save many broken corners or chipped edges. If there is nothing more convenient at hand, the panels may be carried about on an ordinary truck; by first placing a board on the bottom of the truck, to protect the edges, several panels may be carried at a time without danger of chipping. See Fig. 4. This is a very simple matter, but one quite commonly neglected.

A safe and sane method of piling or stacking slate is to stand the slate on end, leaning against a wall or post, and resting on two narrow boards or strips of wood, which reduces the chance of chipping the edges. See Fig. 5. The average size slate should never be piled flat one piece above the other on the floor, as this makes it an awkward proposition for a man to pick up a heavy slate from the pile, and he is obliged to work it back and forth on the pile until projecting over far enough to get a grip.

It is unnecessary to make a line for a bevel on panelboards. The bevel on the average panel is usually so narrow that any man with a flat file and a little active gray matter, ought to do the job very easily. One mistake commonly made in beveling is to file the full depth for a few inches, move along and file another few inches. This method of filing might answer in a manicurist parlor or for a fine-tooth saw, but will prove a botchy-looking job on slate. The filing should be done working across the full length of the slate, a few strokes at a time, each stroke covering several inches, and all the cutting done with the outward stroke.

The Marble Stain That Would Not Come Off.

An ironclad rule in force at a prominent switch factory in the East is that all marble must be handled only under conditions entirely free from grease or oil. This rule, with but few exceptions, has proven effective. However, a few weeks ago, the shipping clerk was dumbfounded, on looking over a lot of marble switch bases previous to packing for shipment, to find the marble badly discolored with a stain closely resembling grease or oil. Gasoline, benzine and every other known remedy for removing oil stains were all tried without success.

To prevent a recurrence of this difficulty, steps were taken to locate the cause. From the receiving room to the shipping department, through each different department, the trail of the stained marble was closely followed, but with no results, except that this particular marble had been put through the works with the same care and under the same conditions as had hundreds of other marble jobs. No clues were found that could throw any light on the matter until several days later, when the foreman of the drilling room, who had a keen mind for getting at the bottom of things, found the answer.

The men in the drilling room, after completing their work, would place the marble or slate bases face to face on a truck, with pieces of corrugated cardboard between the slabs to prevent scratching or marking the face. This method had been followed satisfactorily for several years, when moving this material from one department to another. A few days before the mystery of the stained marble, a new consignment of this cardboard had been received and, owing to either a different quality of pulp or some chemical change in the dye used, needed but the moist condition of the marble, which is usually drilled with water, to run and quickly spread in the absorbent marble, leaving a stain that was impossible to remove.

According to all literary traditions after the mystery is cleared there should be a happy ending. Unfortunately, however, there is no "all ends well" to this episode. This particular shipment, consisting of 27 marble bases, with the labor, represented a loss of nearly $60, saying nothing of an irate customer many miles distant who was tearing his hair in impatience over the much delayed shipment of marble. This perhaps may make clear to other impatient customers when goods promised in February fail to arrive until June, that somehow there was a slip for which the manufacturer himself was not to blame.

Shop-Economy Ideas for the Contractor

A Few Common-Sense Hints for the Electrical Contractor Whereby He May Stop Many Small Leaks Whose Total Very Frequently Turns Profit Into Loss

By HENRY C. PECK

IT IS surprising how many business men will let their business run along with just enough margin to eke out a living, simply because they overlook the small leaks in their mad rush for coins with an eagle on them. The small leaks which almost any firm has in its system amount in the period from one inventory to the next, to a surprisingly large sum, and it is the intention of this article to locate a few of them.

Attention to Small Leaks Brings Large Aggregate Gain.

How often do we hear the expression, "That only amounts to a few cents," or "A dollar once in a while doesn't matter much," but the writer knows of a shop in one of the central states which has made its owner practically independent in a few years by cutting out little expenses, while his dozen competitors who are looking for bigger things are wondering if there will be a dividend at the end of the year, and yet he actually can afford to and does take contracts for less than the others because his total costs are less.

Tidy and Convenient Arrangement of Stock.

One thing too often overlooked and which, by the way, is not a small leak, is the appearance of the store. In any city can be found shops in the windows of which are a few dusty articles, more thrown in than displayed, and on the middle of the store floor some motors where they are in the way, as well as stock on the shelves dating from Franklin's discoveries to the present day and covered with dust accordingly, while articles which are sold over the counter every day, such as batteries and lamps, are crowded into the back room or basement, thus making an automatic truck out of the stock clerk and delaying the customer.

It is a psychological fact that the average person will trade where it is the least trouble to get what he wants, providing the price seems reasonable, and he likes to be flattered to the extent of being made to feel that it is a pleasure to wait on him. Just stop and think for a moment, Mr. Contractor, of the stores where you trade and the reason therefor, and then see if you give others the same reasons for trading with you. Ten to one it is because you get more for your money or else because the service is better, and in the latter case the store-keeper is making a larger profit. Which do you prefer?

With the parting remark that a customer deserves, but often does not get, the same courteous treatment over the telephone that he receives when he comes into the store, let us turn our attention to some of the smaller leaks, the chief of which are losses of time.

Time-Saving in the Stock Room.

In the stock room the material should, as far as possible, be arranged so the articles for any job can be gotten out in rotation, thus saving the stock clerk's time and avoiding delays to the workmen while waiting for material. Also by keeping all goods of a kind together much time can be saved in taking inventory and it is also immediately apparent when the stock is running short. In this connection, let it be said that estimate sheets should be checked over as soon as a contract is landed and supplies for the work kept on hand at all times as any material which is out of stock must be bought immediately at an advanced price for small quantities or else the workmen must go back over the job later and install it and this takes much more time than to finish the work as they go along.

Time-Saving by Using Automobiles.

Most contractors at the present time use automobiles, but there are plenty who still depend on a dray and the street cars or the employees' feet for cartage and this is quite an item in itself, but when one considers the waste of time due to waiting at the job for tools and material to arrive and for the foreman to go over the job as well as the time lost in traveling, it is easy to see where the price of more than one roadster goes to in a year, even in a comparatively small shop.

It is also good policy to have the men call up for material instead of coming in after it and to have them call up a couple of hours before a job is completed so the machine can be sent for men, tools and material and all these taken right to the next job with very little loss of time. The average man will work harder and take more pride in his work as to quality and quantity if he feels that the company is helping him to make good, but if it is lax about economy, he will be also, and usually more so.

Have Meter Boards on Hand.

One place where quite an amount of time can be saved is by having a few meter boards made up for the usual run of small jobs, such boards being made during what would otherwise be waste time and kept on hand to send out with the material. This saves considerable time because things are handy in the shop for such work and are not on the job and, even if the general contractor will furnish the lumber, this method will be found cheaper in the long run. Old boxes may be used for this purpose or any cheap lumber, and the cabinet with switches and cutouts all mounted and wired up, even to the meter loop, and the board painted with asphaltum.

It will be found cheaper in the end to use a combination entrance switch and cutout, for while the first cost is more, a smaller cabinet may be used and less work is required to wire it up.

Fittings and Other Material Sould Be Ready.

The fittings for one-half and three-quarter-inch service pipe may be gotten out in advance and put into small boxes which should contain the proper condulets, locknuts and bushings, two or more pipe straps, three ground clamps, two sizes, and necessary screws. In this way no time is lost in getting out the material when it is wanted in a hurry or in hunting for it on the job, and these things are rather elusive when dumped in with other material on account of their small size. Plenty of nails and screws should also be sent out, for the extra ones will come back while, if he runs short, the wireman will have to go out and get more and this on the employer's time.

Changing Men Is Usually Poor Practice.

Another practice in many shops is to needlessly change men on jobs. I say needlessly because it is better by far to turn down a job than to lose a customer and considerable time of the workmen by changing to take care of the extra work. You will get another chance at the man whose

work you turn down but not at the one whose work you neglect, and the loss of future business is not the only result, for it takes time for the workman to pack up his tools and get to the next job and more time for a new man to get himself "located" on the partly finished one, and this has to come out of the profit. Besides this, the second man does not take the interest in the job that he would if he had handled it from the first, and is not "the other fellow" always to blame for the mistakes that occur? This practice also often leads to errors due to misunderstanding or forgetting what is finished and what is not, and this means extra trips back to the job to repair the trouble and perhaps the tearing up of some finish in a new building, which will not improve the chance of obtaining another job from the customer.

Necessary Tools Shuold Be Ready.

Much time can be saved by having proper tools for the men to work with, such as step ladders, boring machines, pipe-fitting tools, etc., for while money is tied up in them, it is first cost only, and the time lost for lack of them goes on *ad infinitum*. It is useless to expect a man to turn out as much work standing on a barrel and using an angle brace as if he had a boring machine. A good method of keeping track of such tools is to have a number stamped or painted on each and this number put down together with the job they go on, thus eliminating the possibility of forgetting where they are. They should be brought back to the shop as soon as the men leave the job, even if for only a few days, for the chances are that some one will have taken them away if you don't.

Send Out Men Familiar With Job.

It is good policy, when possible, to send the man who roughed-in a job back to set the switches and finish up, for he knows of any special material that will be required and, in case there is any trouble in tracing out the connections, he knows how the circuits are run, while another man will have to take the time to locate things by testing. It is good practice in this connection to have the wireman make out a list, when he leaves the job after roughing-in, of all articles necessary for finishing up, such as bells, switches, plates, etc., thus eliminating the possibility of sending out the wrong material or finish, which will mean an extra trip back to the shop.

In closing, let it be said that this article is merely intended to cover a few of the many small items of loss. Each contractor may, with great advantage to himself, study the little leaks in his individual business and if he does this, he will be surprised to see how much money he can save by making a thoughtful study of this important subject.

Have Extra Hack-Saw Blades Handy.

By H. Nickels.

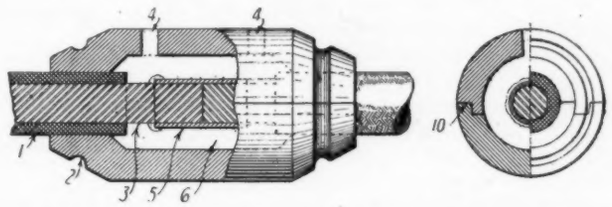
The most convenient and practical place to keep extra blades for the hack saw is to tape them to the hack-saw frame with a little tape at each end. Three or four blades can be taped on in this way very easily. When the blade in use breaks, there is always one handy to put in its place without waste of time. Many wiremen carry an extra blade or two loose in the tool bag, but these are apt to be lost or broken if a heavy tool is thrown into the bag. The taping of a few blades to a saw frame of two or more parts also holds the frame together until the new blade is put into place.

I have used this scheme in the shop as well as when taking the tool bag to a job. A few reserve blades carried in this way are an assurance that when the stock in the shop runs very low the work will not be tied up. In fact, when I notice that I have only a few blades left after taping a batch to the saw frame, I immediately order a new stock.

An Insulating Joint for Use in Large-Cable Splices.

By O. F. Dubruiel.

It is a common practice in the connection of electric cables or large conductors to cover the joints made in same with tape. Let us take a large-size conductor, say 1,000,000 circular-mil, for example. In order properly to insulate such a connection it will require several pounds of tape and considerable time to place this tape properly on the joint. When it becomes necessary to open this joint, all this tape and labor is a dead loss and must be replaced again anew if this joint is again to be placed into service, which means considerable



Figs. 1 and 2.—Partial Longitudinal and End Sections and Elevations of Insulating Joint for Large-Conductor Cables.

expense. Having to do with cables of various sizes, and in view of the present high cost of material, I took it upon myself to try to reduce cable-joint expense and the device shown in Fig. 1 is what I believe has solved the problem.

Fig. 1 is a partial section of one of the joints of my design, being just a plain splice, although I have used the same scheme in branch and cross taps, etc. The joint shell is in two parts and is made from insulating material. Referring to Fig. 1, *1* is the cable entering the joint, *2* is a groove near each end of the joint for holding a tarred marlin used for tying the joint together; *3* is the bare copper; *4* are two holes in the top half of joint for filling in the insulating compound; *5* is the connecting sleeve; *6* is the space around the conductor filled with compound.

The joint is very simple and can be applied in a very few moments, the operation being as follows: The electric conductor is spliced in the usual manner, then the lower half of the joint is placed under the splice and held with one hand, while the upper half is placed into position over the lower half. The tongue and groove *10* keep both the upper and lower pieces in line; with a tarred marlin both ends are tied together in the grooves *2*. This holds the joint firmly to the cable; the outside of the conductor insulation fits tightly into the ends of the joint shell. By means of the holes *4* the insulating compound is poured into the joint, which when full seals itself; and the joint is now complete.

I have used this joint on 440, 2,300, 6,600 and 16,500 volts in single, two and three-conductor cables. When I use this joint in connection with a lead-covered cable, each joint is made up as above and the usual lead sleeve is put over it and compound sealed as usual. When it becomes necessary to open a joint, all that is necessary in the case of a three-conductor lead-covered cable is to remove the sleeve in the usual manner; by applying a little warm compound to the hard compound of the joint it can be removed with ease. In the same manner with the insulating joint, a little heat from the warm compound will let it loose from the inner compound and it can be removed, the joint inspected or changed, and the same material can be replaced without any loss of material and very little time. This can be repeated as often as necessary and the joint is always good. With care very little compound is wasted on removing the joint shell.

S. D. Moran & Son, South Bend, Ind., recently finished the electrical work on a new high school building in Sault Ste. Marie, Mich., and are now wiring the new Lake Linden (Mich.) high school.

Indemnity Insurance for Contractors

How the Electrical Contractor Has Been Enabled to Secure Compensation Insurance at Low Cost Through Efforts of State and National Associations

By GEORGE W. HILL

IMPORTANT ELEMENT IN "OVERHEAD"

Mr. Hill's article in the last issue discussed the evolution of employers' liability and workmen's compensation and showed the importance of making proper provision therefor.

In this article he shows that through inter-insurance, in cooperation with state and national electrical contractors' associations, valuable economies have been achieved.

DURING the year 1913, the attention of the Illinois Electrical Contractors' Association was called to inter-insurance through the efforts of other trades who had taken advantage of this form of insurance, such as the laundry men and others who were employing large numbers of persons in their business. E. J. Burns, then secretary of the Illinois association, was instructed to make certain investigations and recommendations which would have a tendency to relieve the contractors of the state from paying what seemed exorbitant rates for compensation insurance. Mr. Burns made an extensive investigation and came before the state association convention with a very feasible plan of inter-insurance which was indorsed by the association, and all members were urged to place their insurance with Mr. Burns.

Illinois Experience with Inter-Insurance.

Many members placed their insurance in the hands of Mr. Burns with the remarkable result of effecting a saving of something over 50 per cent to all members so insured over the amounts paid to old-line or conference companies. Among the most notable cases were those of the savings effected to the Freeman-Sweet Company, of Chicago, of some $500, and the Electrical Construction & Machinery Company (Jack Marron's company), of Rock Island, Ill., who were among the heaviest insured under this plan.

A little later on the Iowa Electrical Contractors' Association took advantage of the plan and a joint arrangement was entered into whereby Mr. Burns was to look after the insurance for members of both state organizations. Many Iowa contractors took advantage of this plan, and decided savings were effected.

Opposition of Old-Line Companies.

This was not all accomplished without the most vigorous efforts on the part of conference companies who could see the hand-writing on the wall. There was danger of their great power breaking down this thus far feeble arrangement at any moment. At this time it was evident that the conference companies were maintaining rates that were found to be much in excess of an equitable amount to cover the electrical-contracting hazard.

National Association Takes Up Question.

Many diplomatic twists and turns were necessary to maintain this arrangement until some time during the early part of the year 1914. The Executive Committee of the National Electrical Contractors' Association then became interested in the proposition and Mr. Burns was invited to attend the national convention at Detroit in July of that year, at which time this plan was discussed fully by members of the Executive Committee and Mr. Burns was requested to prepare some plan which would bring about the adoption of this type of insurance as a means of benefiting the entire membership of the national association. This required considerable careful planning, as in some states inter-insurance companies were not permitted to operate and blanket policies were necessary. Immediately after the national convention, however, Mr. Burns, in casting about for something which would be attractive to the National Electrical Contractors' Association members became acquainted with Lynton T. Block, attorney for the Utilities Indemnity Exchange, of St. Louis, Mo., which was operating an inter-insurance exchange, restricting its activities to the electrical field and up to this time to public utility companies, particularly central-station companies and operating telephone companies.

Dealings with Inter-Insurance Exchange.

With the passage of workmen's compensation laws in many states, provision for liability insurance became an urgent matter a few years ago and this exchange consequently undertook at first only this branch of insurance for its electrical members. The universal satisfaction with which the insurance was handled by the exchange and especially the economy in the net premiums as compared with those of the old-line insurance organizations recommended itself to Mr. Burns.

Mr. Block's attention was called to the wonderful field in which to operate with practically the same class of risks which he had been handling for the public utility companies. Several conferences were held and eventually a plan was consummated. However, about this time Mr. Burns severed his official connection with the Illinois and the Iowa Electrical Contractors' Associations and matters pertaining to his new duties demanded so much of his time and attention that, so far as the National Electrical Contractors' Association was concerned, the matter was turned over to a committee, of which J. A. Fowler, member of the Executive Committee, was appointed chairman.

Whatever success inter-insurance has achieved in the trade may be credited to the untiring efforts of E. J. Burns, of Rock Island, Ill.; J. A. Fowler, of Memphis, Tenn., and their co-workers in the Illinois and Iowa state associations and the national association. The first efforts, so far as the electrical contractors are concerned, were made by the Illinois association. It was there that the idea of economical liability insurance for electrical contractors was born and it was through its efforts that all things pertaining to compensation inter-insurance for electrical contractors were first made possible.

At the following national convention of the National Electrical Contractors' Association the plan of the Utilities Indemnity Exchange was adopted and recommended to all members of the association.

Joint special representatives of the Association and the Exchange were employed to secure members for the National Electrical Contractors' Association and to write insurance under this plan. Fire and automobile insurance

were also written under this general inter-insurance plan.

While there was no question as to the savings effected, many contractors found it advisable to remain with the old-line or conference companies because of local influence brought to bear. Many insurance agencies are also real-estate agents, handling the properties of non-residents and having the letting of much electrical work during the year; this leverage was employed to retain the insurance business of quite a few contractors. Gradually rumors were heard of the old-line companies practically meeting the rates of inter-insurance exchanges and where this was actually done many of the contractors, for local reasons principally, transferred their business back to the old-line companies.

Typical Advantage from Association Action.

Thus it is that co-operation scored another hit. Several different interests working together in the belief that each individual interest would be benefited thereby have accomplished many desirable results and the ultimate reduction of insurance premiums is only one of the many good things which come to those working co-operatively. Members of an association like the state and national contractors' associations must remember that they should be grateful to the association as a whole for the things which do not happen to them, as well as the things which do happen.

Determination of the Voltage Induced in a Short-Circuited Alternator.

By J. F. Wilson.

In determining the regulation of an alternator by the "zero power-factor" method, the zero power-factor full-load magnetization curve must be obtained experimentally, or by calculation. Experimental determination of the curve is to be preferred, but is not always practicable. In calculating the zero power-factor curve, the voltage induced in the short-circuited armature must be determined. This voltage may be determined either graphically or experimentally.

Graphical Method.—Referring to Fig. 1, curve *OX* is the open-circuit magnetization curve of the alternator; *OA* is the field excitation required to cause rated current to flow in the short-circuited armature, and *A* is a point on the zero power-factor curve. Through *A* draw a straight line perpendicular to a tangent to the open-circuit magnetization curve. This

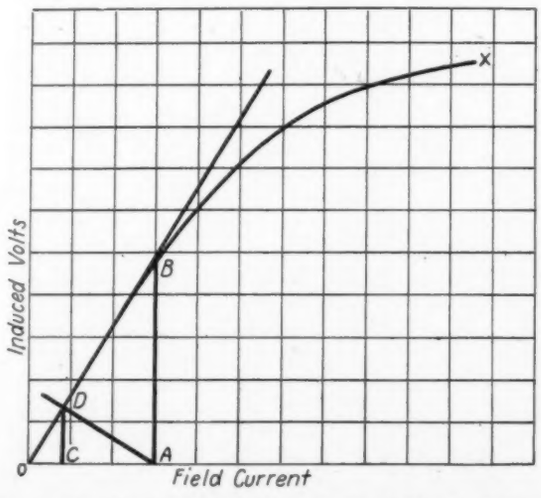


Fig. 1.—Graphical Determination of Short-Circuit Voltage.

line intersects the magnetization curve at *D*, and the ordinate *CD* is the voltage induced in the short-circuited armature winding.

Experimental Method.—On the frame of the alternator wind a narrow band of insulated wire, and connect a voltmeter as indicated in Fig. 2. Drive the revolving-field structure at rated speed, and read the voltmeter when rated current flows in the short-circuited armature. Open the short-circuit, and take a second reading of the voltmeter for the same speed and field excitation. The deflections of the voltmeter are proportional to the flux passing through the armature and to the voltages induced in the armature winding. Referring to Fig. 1,

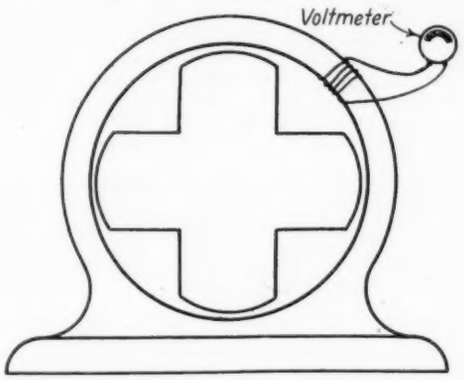


Fig. 2.—Experimental Method for Finding Short-Circuit Voltage.

$$CD = V_1 \times AB / V_2.$$

The voltage induced in the short-circuited armature is due to field excitation *OC*, and the excitation *CA* neutralizes the demagnetizing effect of the armature current.

Among the Contractors.

A. L. Mengel has purchased the electrical business conducted under the firm name of Tiffany's at 303 East Weber Avenue, Stockton, Cal. The business will be continued under the same firm name and the management of A. E. Commeford.

The Evans Electric Company, Kansas City, Mo., has received the contract for the lighting and power to be installed in the extension built on the garage station of the Kansas City Board of Park Commissioners at Seventeenth and Woodland Streets. The company will install a light and power plant in the new creamery of the Harding Creamery Company, Omaha, Neb., estimated to cost $1,500.

The K. C. Electrical Construction Company, Kansas City, Mo., has been awarded the contract for repairs and materials in wiring for electrical light and power in the new grain elevator of the Hynes Electric Company, Council Bluffs, Iowa. The contract will amount to $6,000.

The lowest bid for furnishing lighting fixtures for the Portland Public Auditorium was submitted by M. J. Walsh Company, of that city.

The Central Station Equipment Company has completed the installation of a new fire and police alarm system at Union Hill, N. J. The boxes are of the new combination police and fire-alarm type.

Frank Hyne has purchased Tomlin Brothers' electric shop in Evansville, Wis., which will be conducted under the name of the Hyne Electrical Supply Company.

The Petra Light Company, at Monroe, Wis., has been sold to G. A. Black and J. J. Tschudy, who will carry on the business under the firm name of Black & Tschudy.

The contract for wiring the new city hall in Tucson, Ariz., has been let to the Russell Electric Company, of that city, on its bid of $1,530.

DOLLAR WIRING KINKS

All readers are invited to contribute to this department. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; if a diagram is necessary, a rough pencil drawing will serve. The idea itself must be new and bright. A dollar will be sent to the contributor upon publication.

Quick Way to Cut Slate Slabs.

I have found that a quick way to cut slate slabs is as follows: Mark the slate by scratching over it several times with a sharp tool or instrument, using a T-square or ruler to make a straight line. Clamp any straight edge along this marked line to use as a guide in cutting. Sprinkle a small quantity of fine sharp sand over the marked line, adding a little water to it. Take an old saw or a piece of thin sheet steel of about the same thickness as a saw blade and file a few nicks in the edge, using this as a saw. Slowly move this back and forth over the line, adding sand and water as needed. I have found this to be a quick and reliable method of cutting slate; cutting it this way leaves the edge in a smooth and even condition.

V. R. Sibilee.

Keeping Concrete Out of Conduit.

In fireproof concrete buildings where conduit and outlet boxes are nailed on the wood forms several methods are used for keeping concrete from running into the conduit. I have tried them all and have discarded them in favor of the following method. The wireman always has with him a bit and brace for boring holes for switch and bracket outlets. When you mark the center for the outlet box, bore a hole where this is marked. Nail the box right over the hole so any concrete running in will flow out through this hole in the wood form and not run into the conduit. This scheme can be used especially where the conduit enters the box from above. I have found this to be the best method, as corks or plugs are nearly always coming out and when blind washers are used the bushings are likely to come off.

E. E. Krause.

Counting Device for Coil Winder.

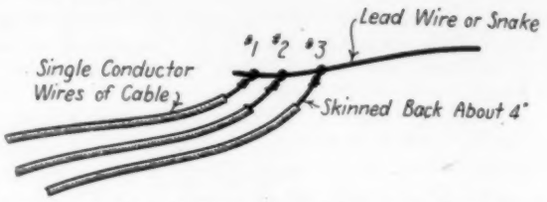
In the issue of December 16, 1916, there was an article on this subject that was written by H. L. Metcalf. I am using a still simpler device. It is an ordinary speed or rotation counter, such as electricians use for finding the speed of shafting, motors or other machines. The tip is fastened to the shaft of the core on which the coil is being wound; a clamp is used for this purpose which is simply made from a piece of tubing split at one end and having a screw arranged at the side to draw it together, like a BX connector. The other end can be arranged in the same way, or it can be permanently soldered to the end of the rotation counter. The body of the latter is secured to a block of such height as to bring its spindle just opposite the core of the coil being wound. This gives an exact counting of the turns put on the coil.

counting of the turns put on the coil. E. Kalkau.

Simple Make-Up for Multiple-Conductor Cable.

When installing multiple-conductor cables that are made up of a number of single-conductor wires, as frequently is the case in signal or special lighting systems, where each wire must be tested out or tagged after the cable is installed, much time and labor may be saved by the following method.

As the cable is being made up, each end of every wire is skinned about four inches and twisted around a "lead" wire, which is any piece of wire strong enough to pull the cable in, or the snake end may be used. Both ends of the cable are made up at the same time with each wire taken on in turn over the last one by a loop around the lead wire and two twists around the conductor, making a tight loop that cannot easily pull over another one, as shown by the sketch.



Assembling Multiple-Conductor Cable in Numerical Order.

After all the conductors are put on in their proper sequence, the cable is pulled in and is ready to be connected. Each wire on each end is now cut off in the order they were put on and connected in place without tagging, pulling or ringing out. The lead wire serves for pulling in the cable and it takes no longer with this method than it does to fasten the wires on the usual snake hook.

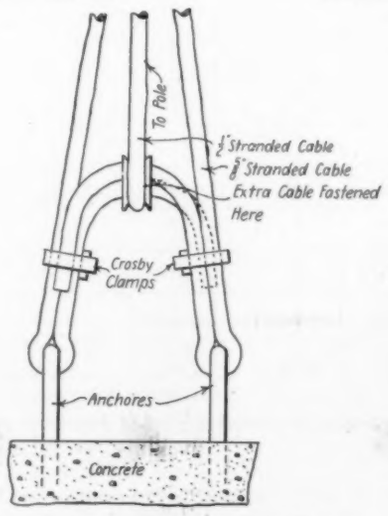
George A. Broder.

Test for Conduit Tracing.

A simple method of testing conduit, where doubt exists as to where it runs between outlets, is given below. Recently it seemed impossible to fish through some conduits so I made the following simple and satisfactory test. A small hand-operated automobile pump was used. The end of the pump tube just fitted the one-half-inch conduit. Air was pumped into the run of the conduit. A helper placed his finger over the different outlets, holding it there a moment to allow time for air to accumulate. When the right one was found the air leakage passing between outlet and finger could be heard or felt by the helper. If the pressure is slight, simply moisten the finger to make it more easily felt. For a larger conduit use a washer made of cardboard. Place this washer on the end of pump tube and then over the conduit. Cyril Neuses.

Three Guys Secured to Two Anchors.

On a recent installation after two anchors, which were holding two five-eighths-inch cables used to guy an iron pole, had been set in concrete, it was found necessary to place another guy on the pole from the same direction but to a different height on the pole. In order to avoid setting another anchor the method shown below was adopted. The loose ends of the five-eighths-inch cables were bent together and fastened with a Crosby clamp and the third cable fastened between these ends as shown. Thomas Connor.



Securing Three Guys to Two Anchors.

DEALER AND STOREKEEPER

An Exchange of Ideas and Experiences on Advertising and Selling Methods, and Storekeeping for the Dealer in Electrical Appliances

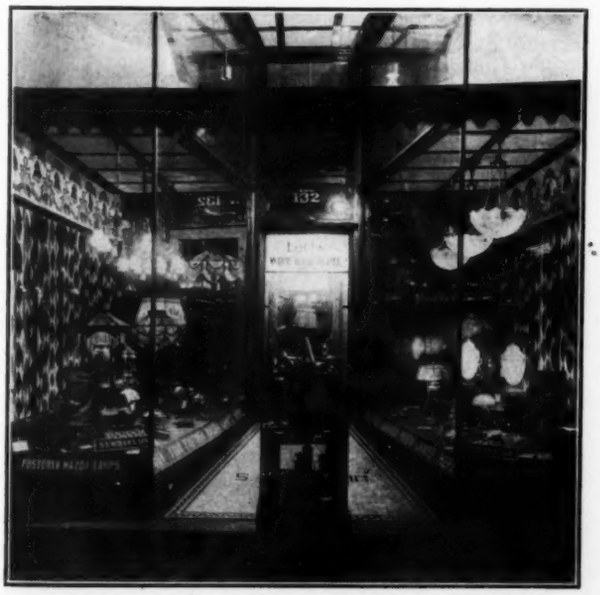
HOW AN ELECTRICAL CONTRACTOR ENTERED THE MERCHANDISING BUSINESS.

Reasons for Branching Out and Creating a Store for Profitably Retailing Electrical Goods.

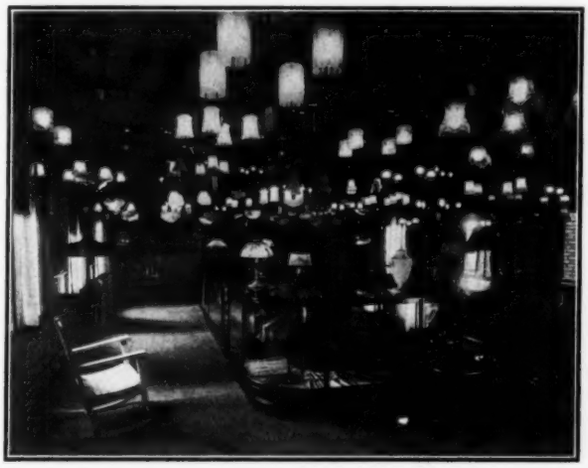
This is an argument for the contractor-dealer; that is, that the business of electrical contracting is a legitimate avenue to that of merchandising electrical goods, and that the contractor is justified in becoming a dealer. Also, that the contractor as a dealer has greater opportunities for making a success of merchandising than any other dealer.

There is no one, not even the central-station company, better qualified to know the electrical wants of the public, and to supply them, than the contractor. If he has a going business that has been on a stable basis for some time it is the most natural consequence for him to branch out into the retailing of electrical appliances. Several things point his road. His associations with the public have been in the way of creating outlets for the use of electricity. His business has served to make him acquainted personally with a large number of electricity users, placing him in a position to know how they use it, and, more than that, how they could use it. Added to all this, the contractor is at an advantage because he understands electrical devices and their uses, and is able to make repairs and maintain them.

An illustration of these arguments is given by the firm of S. D. Moran & Son, of South Bend, Ind. This concern has been in the electrical contracting business for a number of years and has done a large amount of work, not only local but throughout Indiana and Michigan. However, no retailing of electrical goods had been done until this fall. At that time the concern secured the lease of a store on one of the busiest retail streets of that city, and the decision was made to enter the merchandising business, not only on account of the new location but because former patronage seemed to demand it.



Store Front of S. D. Moran & Son, South Bend, Ind., Showing How the Most Can Be Made of a 20-Foot Frontage—The Display is a Pre-Holiday Exhibit of Electrical Goods.



A View in the Lighting-Fixture Room.

First plans were occupied chiefly with remodeling the store front and the interior to secure facilities for doing a purely merchandising business. Realizing the value of only a 20-foot frontage on a business street, a deep central entrance was provided, giving two show windows of fairly good size. In the interior it was found necessary, in order to avoid crowding to arrange for a central aisle with two rows of showcases, the latter and the wall shelving serving to display the stock in a neat and attractive manner. The showcases are roomy enough so that one article does not detract from the appearance of another, and the tops of the cases are handy places to display special lines and all sorts of appliances which customers are at liberty to pick up and inspect.

Because they have sold many lighting fixtures, Moran & Son perhaps paid more attention to fitting up a room for the display of them than to any other part of the store. The room is 25 by 40 feet and unusual, as can be seen from the accompanying illustration, in its appointments. What is out of the ordinary is the square of showcases in the center of the room, these being used to break the expanse of floor space as well as for displaying table lamps. The decorations and furniture are in white, which, contrasted against the soft green carpet, give an atmosphere of coziness, which is borne out by the chairs and settees provided for customers. The lack of an overdisplay of fixtures is noticeable and in a great measure a relief to the bewildered customer. Another point in connection with the room is that while the entrance to it from the store is large, a drop curtain has been provided to shut it off, so that the store noises will not distract customer and salesman.

There are a number of good features regarding the service given to customers that might be emphasized. It is enough to say, however, that the methods of dealers in other lines are not superior, and that customers receive the attention, courtesy and consideration that electrical dealers should become noted for, and which, with merchandising ability and store appointments have justified the firm in branching out as electrical dealers.

Business Hints for the Electrical Dealer

Selling Service with Electrical Toys—Suggestions for Securing Lamp Trade—Relation Between Store Location and Class of Trade—Giving Customers the Benefit of the Doubt — Specializing in Sales Work

By G. D. CRAIN, Jr.

ONE fact that the Christmas season of 1916 has demonstrated is that electrical toys are a growing feature of the business, to which dealers in electrical appliances will find it worth while to give even more attention. Further, with sales of this class of goods being made in volume by general stores, which have no special knowledge of the goods, the electrical dealer should call the attention of the public to the fact that expert service accompanies every sale of an electrical toy in his store.

This is an item of more than ordinary importance, not only on account of the considerable cost of some of the toys, especially when they are accompanied with batteries, motors, rheostats, etc., but because definite instructions must be given the purchaser who is not acquainted with the principles of electricity. The ordinary $5-a-week girl "suping" in a department store at Christmas is evidently not the best person to go to for expert advice along this line, and the purchaser who buys without getting instructions is running the risk of having more or less trouble, which will be obviated if the toy has been purchased in an electrical shop.

Speaking of electrical toys emphasizes the sales possibilities of transformers. These are placed on the market by a number of reliable firms, and make it possible to connect the toy outfits to the lighting system, instead of relying on batteries. With a transformer in use, a number of toys, all of varying voltage, can be operated, and the delighted child and his equally delighted parents will have a lot more fun than could be arranged for in any other way.

Toys, by the way, are being sold all the year 'round nowadays and it would pay the dealer to keep a fairly respectable stock of them in evidence all the time instead of just at Christmas.

Getting the Lamp Trade.

While a good many electrical dealers handle reading lamps successfully, it is becoming more and more evident that in order to get anywhere with this line it is necessary to have a stock. The woman who buys a reading lamp—and most sales of this kind are made to women—takes some time to reach a decision, and if the stock is not large she hesitates about making the purchase.

On the other hand, the decorative value of such lamps is so great and their place in the artistic home is so secure that the dealer can readily develop a big volume of business if he will go after it. Individual sales amount to considerable and in the aggregate the possible business is imposing.

A successful salesman, who has had considerable experience with women, and knows something about the indecision of the other sex, said that when he finds that a woman customer is hesitating about buying a certain lamp he has all of the lights switched off, places the lamp in question alone on a table, and then turns it on. Under these conditions, without any distractions, the customer speedily makes up her mind that this is just what she was looking for, whereas with several other lamps all attractively illuminated she has a lot of trouble reaching a specific decision.

Store Location and Trade.

One of the important things to remember about location is that it has a lot to do with the character of the trade handled. The store which is selling goods in one part of a city may be able to move a lot of high-priced stock, and to capture what is known among retailers as the "limousine business." If he were in another part of the same town, with the stock suited for the other location, he would find that his prices were too high for the pocketbooks of his prospects, and that the popular-price trade which he necessarily had to cater to would pass him by.

Consequently it is up to the dealer to study both his location and its possibilities from the merchandising standpoint, and then select his stock according to the kind of business he is handling. For example, in some stores a $5 electric iron is standard, because people who visit these establishments are looking for the best, and don't mind a fairly high price. Then there are other stores which would have a hard time selling a $5 iron, because their trade wants those priced at lower figures.

A certain concern operating in a big city ran for a long time a large appliance store on a famous street of the "exclusive" type and secured the trade of the most prominent people of the town without any trouble. They came in, saw that the company had an especially attractive assortment of goods, and purchased because they were looking for the highest quality.

Later on, it was noticed that business of this character had begun to fall off, and investigation showed that it was because more aggressive advertising of lower-priced lines, for the purpose of increasing volume, had brought into the store many customers who ordinarily purchased on a less exclusive thoroughfare. They were respectable people, but just "didn't belong;" at least, that was evidently the conclusion of the wealthy customers who had formerly purchased there, for the latter had discontinued buying on that account.

In order to meet this situation the company opened another store in a district where popular prices were the normal thing, and where the trade of the people of the middle classes could be handled to advantage. The second store pulled the business of this type, while the first store gradually w back the estranged patronage of the higher-class buyers.

This may seem like a kind of commercial snobbishness, but as a matter of fact it is simply adapting methods to suit conditions. As an evidence of this, the first store, catering to the high class trade, does not price the goods displayed in its windows, while the store in the popular-price territory puts tags on everything it shows.

Giving Customers the Benefit of the Doubt.

While the old saying that the customer is always right is neither true nor a practicable basis for doing business by the average electrical merchant, there is another and more up-to-date slogan which might well be posted in every store. It is, "Give the customer the benefit of the doubt."

In other words, where a reasonable doubt exists regarding the construction of a guarantee or the extension of delivery service, and the dealer could decide it either way—favorable to himself or favorable to the customer—it is always wise to give the decision to the latter, where the case is plain one way or the other there is no sense in deciding any way except according to the facts, but there are innumerable times when there is reason on both sides.

In a case of this kind the customer is entitled to consideration and to what the baseball players call the "breaks." You can afford to give your patrons the "close ones," as the diamond performers put it.

For example, a salesman came to the manager of a big electrical store recently and asked regarding free delivery to a certain suburb some distance away.

"The customer said that other stores made this delivery," he said, "but I didn't tell him whether we would send it or not."

"Did the customer understand that we would pay the delivery charges?" inquired the manager.

"Yes," said the salesman, "I think he did."

"All right, then," said the boss, "though it is contrary to the rules to deliver that far out, we'll send it express, prepaid. Don't let a customer leave in doubt as to what we are going to do for him. It's better to explain that we can't do a thing than to leave it up in the air. That's the sort of thing that drives away business."

Specializing in Sales Work.

In the larger electric appliance stores, it has been found that better results can be obtained by assigning certain salesmen to certain classes of stock. This does not mean that they are not to acquaint themselves with other classes of goods, but that they are to specialize on those to which they are best suited. In this way the store succeeds in getting salespeople who are enthusiastic, because they know all about the particular items with the sale of which they have been charged.

Speaking of specializing, a large concern in the East has classified its goods according to the following system:

Lamps, including table lamps, floor lamps, desk lamps, boudoir lamps, piano lamps, silk shades, etc.

Heating appliances, such as flat irons, toasters, chafing dishes, curling irons, heating pads, etc.

Ranges, ovens, etc.

Small motor devices, including vibrators, sewing machines, sewing machine motors, toy motors, fans, etc.

Washing machines.

Vacuum cleaners, including suction cleaners.

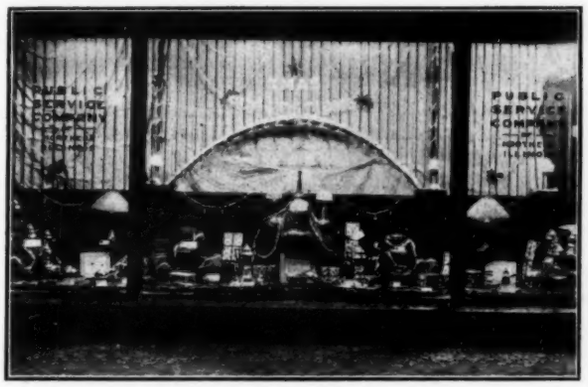
Therapeutic devices, including high frequency outfits, therapeutic lamps, etc.

By using different salesmen in these various departments the store gets better results and customers get better service.

Two Attractive Christmas Windows Which Influenced Sales.

Two very attractive Christmas windows, which may easily be adopted for other seasonable displays of electrical appliances, are shown in the accompanying illustrations. Both are windows of the Public Service Company of Northern Illinois, one being at Oak Park, Ill., and the other at Maywood, Ill. Electric shops are maintained at both locations and modern merchandising methods are employed, as is indicated by the attractive window displays. All goods are sold at list prices.

In arranging a window display of electrical appliances, especially at Christmas time when it is desirable to present as many different suggestions as is possible in the limited space available, it is usually the tendency to overcrowd a window and thus confuse the busy shopper who has many shops to visit. In the windows shown herewith a happy medium has been secured. In both instances a great variety of devices is shown and still there is not the slightest degree of crowding.



Christmas Window at Oak Park, Ill.

Christmas Window at Maywood, Ill.

Portland Dealers' Novel Window Displays Win Prizes.

There is no question that the well of new ideas in window displays is bottomless. This is confirmed time and time again by the novel displays made by electrical dealers throughout the country.

The accompanying illustration shows the window displays of the Morrison Electric Company, of Portland, Ore., which because of their novelty and attractiveness, won the electrical prize in the Greater Portland Association display contest as well as first prize in an America's Electrical Week contest.

The excellent arrangement of the exhibit can be seen from the illustration, and the effective color scheme, which was in red, set off the appliances in an attractive manner. The window space was used for displaying the latest and most novel electrical devices on the market, including two electrical racing automobiles, and what is considered the smallest power plant in the world, generating one candlepower.

Prize-Winning Portland Window Display.

BOOK REVIEWS

"Alternating-Current Electricity and Its Applications to Industry." Second course. By W. H. Timbie and H. H. Higbie. New York: John Wiley and Sons, Incorporated. Cloth, 729 pages (5 x 7½ inches), illustrated. Supplied by Electrical Review Publishing Company, Inc., for $3.00.

This volume, which treats of the operating characteristics of alternating-current apparatus, is a continuation of "Alternating-Current Electricity, First Course," by the same authors, and, like the First Course, is intended, primarily, for trade-school and other students with a limited knowledge of mathematics. Graphical processes are used almost exclusively. The principal divisions of the subject matter are: The Alternating-Current Generator, the Transformer, Transmission and Distribution Systems, Induction Motors, Synchronous Motors, Converters and Rectifiers.

The subject matter is based largely on experimental facts, and the method of presentation is extremely dogmatic. The statements are generally clear, but some of them are unwarranted and misleading. On page 31 will be found this statement: "There is a direct effect, alternately weakening and strengthening the main field twice during each cycle of E1, but having a zero average effect upon the flux from each pole. . . ." This is true only when the permeability of the magnetic circuit is constant. Again, on page 428, when reference is made to a synchronous motor: "The load torque is due to magnetic attraction of the poles produced by the alternating currents in the 'armature' windings for the poles produced by the direct current in the 'field' winding, ..." But a compensating winding may neutralize the "poles" produced by the armature windings without affecting appreciably the torque of the motor.

The principal criticism of the volume is in regard to its length. This fault is largely because the authors have gone into the minute details of the operation of alternating-current apparatus, and, at the same time, appear to assume that the reader is ignorant of the simplest matters. On this assumption, detailed explanations and repetitions are made which extend the volume to more than seven hundred pages. If the subject matter of the First and Second Courses were condensed into a single volume of four hundred pages or less, it would be well worth while.

J. F. Wilson.

"The Emission of Electricity From Hot Bodies." By O. W. Richardson. London: Longmans, Green and Company. Cloth, 304 pages (5½x8¾ inches), 35 illustrations. Supplied by Electrical Review Publishing Company, Inc., for $2.75.

Probably no one is better fitted to treat the subject of this book than its author, since his own work has led its more modern investigation and theoretical discussion. Although the conducting power of flames was known long ago, and the Edison effect was observed upon the advent of the incandescent electric lamp, it was not until the conception of the electron was formulated that much progress was made in the study of phenomena connected with the electrical behavior of hot bodies. It is only in recent years that we have seen the development of the Fleming valve, the audion amplifier, the Coolidge form of X-ray tube, and the kenotron. These practical applications are not discussed in this book, which is devoted to theory and experimental investigations. Following an introductory chapter, the author discusses Theory of the Emission of Electrons from Hot Bodies, Temperature Variation of Electron Emission, Effect of Gases on the Emission of Electrons, Energetics of Electron Emission, Emission of Positive Ions by Hot Metals, Effect of Gases on the Liberation of Positive Ions by Hot Metals, and Emission of Ions by Heated Salts. The final chapter deals with Ionization and Chemical Action, and describes some of the author's recent experiments in this interesting field.

The book is written for the scientist rather than the engineer, and the theoretical portions involve the use of the calculus, but the non-mathematical reader will have no trouble with the descriptive parts, which give a good account of the facts of the subect so far as they are at present known. It is a subject which is making rapid strides.

"The Universe and the Atom." By Marion Edwin. New York: D. Van Nostrand Company. Cloth, 314 pages (5¼x8 inches), 58 illustrations. Supplied by Electrical Review Publishing Company, Inc., for $2.00.

In contrast to the preceding book, which is confined to experimental investigations and the mathematical theory which may account for them, the author of this volume deals in speculation concerning the structure of the ether and of matter which cannot, at least directly, be either verified or disproven. The recent work of many physicists has been along the line of reducing all physical phenomena to an electrical basis. This author has endeavored to furnish an explanation of the physical universe on simple mechanical principles. In order to make the presentation readable by the non-technical reader, the main features of wave motion have been explained. The author shows familiarity with wave phenomena, but in dealing with electrical phenomena, as where a magneto-electric generator is depicted in Fig. 48, ignorance is shown and evidently the author has never tried that particular experiment himself. The author explains to his own satisfaction the action of gravitation on matter, its non-action on ether, Balmer's series of special lines, the periodic system of the chemical elements, etc. They all depend upon ether structure and properties based on "force rays." Any attempt to solve the riddle of the ultimate structure of matter is of interest to the natural philosopher, and this volume will find many eager readers, especially as the author has interwoven with his theory many of the puzzles of physical and chemical phenomena.

Proposal to Merge Service Boards in Massachusetts.

A bill has been filed in the Massachusetts Legislature which provides for the reorganization of the Gas and Electric Light Commission and the Public Service Commission. The new plan contemplates a board of seven members to be appointed for terms of seven years, the chairman to receive $8,000 annually and the other members $7,500 each, to supervise all the utilities now under the authority of the two boards. Four sub-boards of three members each would be appointed by the chairman, one to deal exclusively with railroads, another with railway matters, the third with lighting utilities and the fourth with telegraph and telephone service.

Opponents of the project see in it a sinister aim to upset the organization of the present Gas and Electric Light Commission, which has been an effective supervising board for upwards of 30 years. In the view of certain interests the present board is too radical, and a change in the personnel of one or two of its members would be welcome to these interests.

Electrolysis Surveys by the Bureau of Standards.

At the joint request of the local utility companies and the municipal authorities, the United States Bureau of Standards has been directing an electrolysis survey of the city of Omaha, Neb. Most of the measurements are being made by the engineers of the utility companies. Measurements are also being made under the Bureau's direction in connection with electrolysis surveys at Altoona, Pa., and Baltimore, Md. The resistance of ground connections from electric circuits is being measured by a representative of the Bureau in a number of other cities and towns of the country.

NEW APPLIANCES

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

Special-Process Copper for Electrical Use.

The Copper Specialty Corporation, Fifty-ninth Street and Woodland Avenue, Philadelphia, Pa., is now prepared to produce electrical parts made from a special-process copper, also castings and drop forgings from this copper.

The new features of this copper are that it is as hard when obtained direct from the crucible as the usual commercial cold-rolled copper, and all drop forgings and castings retain their hardness if reheated; this latter feature is especially advantageous when used in electrical apparatus that may be subject to excessive heat, as commercial cold-rolled copper when heated becomes soft; in other words, this special copper is self-hardening.

This special copper can be more readily machined and a much more perfect thread can be cut on same than is possible now with commercial copper. This copper can also be cast in iron molds, making practically a finished product which is as hard as cold-rolled copper. Under arcing tests this special copper will not blister or pebble like ordinary commercial copper.

This special copper is not an alloy with other metals but is substantially pure copper, 99.80 per cent pure, and shows electrical conductivity of over 92 per cent. The treatment of this copper is by a special flux which renders the copper more readily machined and gives it a hardness and elasticity equal to cold-rolled copper.

It will be readily understood that the expensive method now in use of assembling numerous parts of cold-rolled copper, such as switch contacts, etc., is simplified by this new method, since the parts can be drop-forged in one piece, making a device that eliminates the fitting and soldering of pieces together.

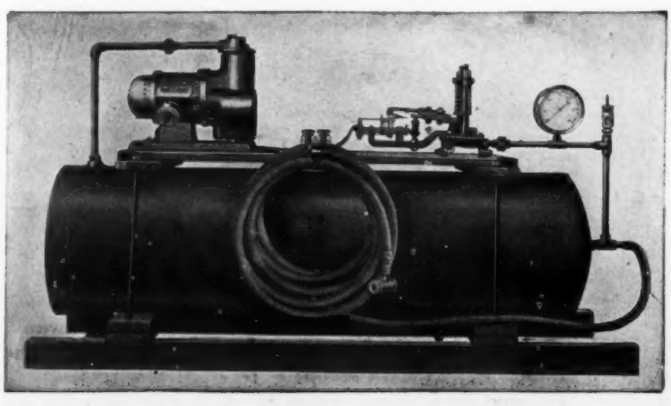
The Copper Specialty Corporation is prepared to submit samples, etc., of its product.

New Model of Electric Air Inflater for Large Garages.

For use in public garages of considerable size, a new model of electrically operated tire inflater has been placed on the market by the Black & Decker Manufacturing Company, 105 South Calvert Street, Baltimore, Md. It is known as the new No. 2 Lectroflater tank outfit. Its motor-driven air pump embodies the same features as were described in the ELECTRICAL REVIEW AND WESTERN ELECTRICAN of May 27, 1916. The new model includes a large-capacity tank capable of holding enough air to inflate several tires from dead flat to full pressure without waiting for the compressor to catch up. An automatic pressure-regulated switch is supplied, however, which starts the motor when the pressure in the tank has dropped to 120 pounds per square inch and stops it when the pressure has reached 150 pounds.

The outfit comes all complete with wiring and piping all connected, so that it is necessary merely to connect to any convenient lighting outlet of 110 volts, either direct current or alternating current, a universal motor being used. An exceptionally strong, triple-braided hose, 25 feet long, is provided with air check fitting any tire valve. The outfit has no exposed electrical or mechanical parts liable to injure any one coming in contact with them. All these parts are inclosed. All bearings run in grease, which requires repacking only about four times a year; only a single grease cup needs then to be attended to, the lubrication being automatically taken care of from this. The compressor and switch units can be quickly removed for inspection or repairs.

This outfit is quite compact, its dimensions being: length, 44 inches; width, 16 inches; height, 31 inches. The weight is 140 pounds.



Lectroflater Outfit with Tank for Tire Inflation.

New C-H Electric Soldering Iron.

The electric heating unit of a new type of electric soldering iron, which is illustrated herewith, is hermetically sealed inside the body of the iron. This prevents moisture, heated solder or flux from penetrating any joint and coming in contact with the heater wire. The same metal—steel—is used throughout the structure of the body to eliminate the liability of opening of seams due to unequal expansion. The copper tip does not screw into a hole in the iron body, but the C-H design is such that a threaded core extends from the body and over this the tip is screwed. The heated core of the body, therefore, passes directly into the copper tip, leading the heat in and concentrating it where it is required.

Five standard sizes of this tool are made by the Cutler-

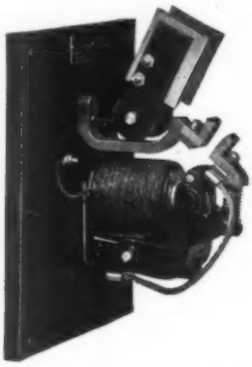
New C-H Soldering Iron.

Hammer Manufacturing Company, of Milwaukee, Wis. The sizes vary in diameter from 0.625 to 1.75 inches. Besides being used for all soldering purposes, they may be used for melting wax, for branding, etc. The advantages of cleanliness, efficiency and convenience of electric soldering irons are well known and further comment is unnecessary.

New Type of Magnetic Contactor for Heavy-Duty Motors.

A direct-current magnetic contactor of new design has recently been placed on the market by the Industrial Controller Company, of Milwaukee, Wis.

The contactor shown in the illustration is a single-pole outfit, but the same design is also used for double-pole



Magnetic Contactor for Controlling Heavy-Duty Motors.

contactors. The frame is of heavy cast iron and so constructed as to allow the contactor to operate at an inclination of 30 degrees in either direction. The contact-finger tips are of heavy copper forgings, the moving and stationary tips being identical.

The design of the contact finger is such that a slight rolling, instead of a sliding, action is obtained, thus avoiding excessive wear and at the same time confining the arc to the upper end of the finger tip and maintaining a clean contact surface.

The contacts are of liberal proportions and close under heavy pressure, giving ample current capacity and rendering the use of auxiliary brush contacts unnecessary.

The magnet coil is designed for continuous duty without the use of protective resistances. A powerful blowout magnet is used and the arcing shields can be readily thrown back out of the way to renew the arcing tips.

All parts of the switch are readily accessible and the entire switch can be dismantled from the front of the panel. The switch has been designed particularly for heavy duty and is especially suited for crane and hoist work and general steel-mill duty.

Oldest Mercury-Vapor Lamp Still Fit For Service.

After having been in use for eleven years, eight months and seven days, the oldest type of Cooper Hewitt lamp in existence, while still fit for further service, has been returned to the manufacturer by E. L. Elmendorf, the celebrated traveler and lecturer. This "oldest living graduate" is shown in the accompanying illustration. It was returned with the original tubes, both of which are still in good working order, the vacuum being intact though the glass was slightly discolored from use.

The work of the lamp has been in connection with the making of lantern slides from photographic negatives, enlarging and reducing negatives, making small and large positives on glass or on paper, and for illuminating flowers, copies, maps, machinery, in fact everything that Dr. Elmendorf wanted to photograph indoors. Since the lamp was installed, he has given up entirely the use of sunlight for indoor photography. Moreover, whenever there was any very close work to be done in his machine shop, like milling sprockets and spiral gears for the motion-picture camera or projector, it was found that better work could be done for longer periods of time without eye-fatigue when the Cooper Hewitt lamp was used. By diffusing the light through the finest gauze, the micrometer scales on the instruments of precision employed were very distinct and easily read without the use of a magnifying glass.

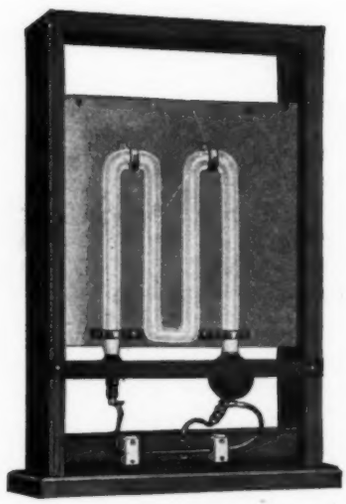
This outfit was in practically constant use during the entire period above stated except during the summer months when the lecturer was traveling. In the fall it was used on the average of 14 hours a day; during the winter and spring from 6 to 12 hours a day, irregularly, depending upon the amount of time Dr. Elmendorf could spare from his lecture work.

Only once during its period of use has the lamp gone out, and that was during a storm when the studio was struck by lightning. However, as the lamp was protected by five-ampere fuses it was not injured, and after new fuses were put in and the current turned on it worked as well as before.

The new M-shaped tube furnished to replace the "veteran" is made especially for photographic enlarging. Its shape enables the light to be concentrated behind the negative, and with two sheets of ground glass it gives perfect diffusion for negatives up to and including those 8 by 10 inches in size.

For years an ideal window of artificial light has been sought for photographic enlarging work. This requires one that has a steady light without a flicker or variation, one that can be used without condensing lenses or many dense mediums to get diffusion and, above all, a light that does not need constant

Dr. Elmendorf's Old Lamp.



New Type of M-Shaped Cooper Hewitt Lamp for Photographic Work.

attention. These results are said to be readily obtained with the new type M-shaped tube illustrated.

As is generally known, the light from a Cooper Hewitt lamp is particularly well adapted for photographic work, so that there need be no guessing about the exposure a plate of known speed should have. This fact, Dr. Elmendorf claims, has saved him at least two years' time out of the past twelve years of work, besides saving many thousands of plates that he lost due to guessing at the time of exposure when using daylight.

WESTINGHOUSE ELECTRICAL DEVELOPMENTS DURING 1916.

New Apparatus and Improvements Brought Out by One of the Leading Electrical Manufacturers.

In turbogenerator work, the conspicuous feature has been the great increase in size of units and in the markedly better efficiency which these very large units will possess over the sizes which were considered to be large but a short time ago. The Westinghouse Electric & Manufacturing Company has now on order several turbogenerator units as large as 70,000 kilowatts in capacity, also a number of machines of 40,000 to 50,000 kilowatts and a great number between 20,000 and 35,000 kilowatts. These very large turbines have naturally called for very large condensers, and many of the latter are now being built, some of them having as large as 56,000 square feet of surface.

Another subject of interest has been the development of steam-turbine arrangements for driving direct-current generators. Many of these units have been contracted for. Most of them have involved reduction gears, permitting the use of high-speed and highly efficient turbines, running at approximately 6,000 revolutions and then employing slow-speed direct-current generators of standard and well established design, eliminating the earlier difficulties of commutation that characterized the effort to direct-connect the turbine and dynamo.

Hydroelectric Units.

There have been a number of large-capacity water-wheel type units sold during the past year, most of them being from 10,000 to 15,000 kilovolt-amperes vertical type, operating at relatively low speeds. The weight of the revolving parts and water thrust is cared for by a Kingsbury thrust bearing mounted on top of the generator. The particular feature of this development is the increasing tendency toward individual units of large capacity.

Direct-Current Generators and Rotary Converters.

The engine-type generator has remained practically the same since the development of commutating poles, five or six years ago, which have proven in the meantime to be a valuable addition from every standpoint. Higher speed generators, usually forming a part of motor-generators, have been improved in that details such as brush holders, brush rigging, etc., have been redesigned. The increased use of the compensating winding in generators has been marked with pleasing results, especially in those designed for very heavy peak-load duty.

The chief developments in rotary converters have been in details, such as improvements in brush holders and rigging and the automatic control for the shunt commutating-pole field on booster converters.

Circuit-Breakers.

The principal development in carbon circuit-breakers has been the method used to produce laminated studs for large breakers. A process of molding copper under pressure is used, resulting in practically the same conductivity for molded studs as was obtained with forgings. The molded stud is so shaped as to provide ventilation through the panel, and at the same time an increased capacity for the same space occupied, due to the increased surface. These studs are easily slotted for standard busbars, the slots being in either a horizontal or vertical plane.

There has been a considerable increase in the use of high-capacity multipolar carbon breakers for the distribution of 440-volt alternating current in large industrial plants. Three-pole breakers up to 12,000 and 14,000-ampere capacity arranged for closing by one solenoid have been supplied.

Cell-mounting breakers have been standardized by the use of single-pole individual units, with all-steel construction, arranged for convenient mounting by sliding the steel bases into channel-iron grooves built in the cell structure.

The tendency has been towards the increased use of round-tank breakers having one tank per pole. A large number of cell-mounting breakers have been supplied for use on voltages up to 23,000 where the normal capacity of generating and other synchronous apparatus tied together approximates 100,000 kilowatts. The tanks in these breakers are of the seamless type, being drawn out of a single sheet of steel. For high voltages and large capacities, round-tank, single-pole, floor-mounting units, with mechanism mounted on the tank, are being provided up to 150,000 volts. In these, the tendency is to mount the operating mechanism inside the tanks so as to obtain the maximum strength of tank against internal stresses by the use of a dome-shaped top of sheet-steel construction riveted to the tank.

Lightning Arresters.

The principal development has been to extend the "safety-first" feature to the popular size arresters for protection of 2,300-volt distributing transformers. An arrester is provided in a cast-iron case with a hinged door, so that upon the door being open for inspection, the arrester element is entirely disconnected from contact with the line, and all parts may be safely handled.

Transformers.

The year has been marked by a large increase in transformer production rather than an increase in capacity or voltage. A single-phase transformer with a rating of 10,000 kilovolt-amperes, the largest single-phase rating ever built, has been furnished by the Westinghouse company, which also has supplied a three-phase, 16,000-kilovolt-ampere unit which has been installed for operation on a 102,000-volt circuit.

A complete line of outdoor current transformers has been developed for voltages up to and including 70,000 to meet the growing demand for this apparatus as a part of outdoor substation equipments. Potential transformers for similar service are also available.

Where replacing cost would be large, a double primary winding for high-voltage current transformers has advantages. The windings may be connected in series for one primary current rating, and in parallel for twice this rating. By means of this scheme, it is possible to double the capacity of the transformer at a later date should it be desired to do so.

Protective Relays.

The increasing diversity and complication of transmission and distributing systems have led to an enormous increase in application of protective relays. A study has been made of the problem, resulting in great improvements in relays to provide the necessary characteristics. With the growing tendency to interconnect feeders, networks, and even complete systems, in the same way that a generation ago short independent railroads were combined into great transcontinental systems, the field for relays has increased very greatly and the Westinghouse company has done valuable pioneer work along these lines.

Potentiometers.

Measurement of the internal temperature of inaccessible parts of electrical machinery, and, in fact, throughout various industries is becoming more important. Thermometers for these purposes have led to erroneous results and are being discarded in favor of electrical means for measuring temperatures. The thermocouple method is

perhaps the most satisfactory scheme yet devised for this purpose. The thermocouple is permanently imbedded in the mass, the temperature of which it is desired to observe, and the thermo-elctromotive force is measured by means of a potentiometer of extreme sensibility. Not only are temperatures of internal parts of generators, motors or transformers so determined, but this development is also being utilized in a number of other applications.

Induction Feeder-Voltage Regulators.

The steadily increasing demand by central stations for alternating-current feeder-voltage regulators was strongly emphasized during the past year. The generally prosperous business conditions prevailing have very naturally resulted in increased lighting loads, which have in turn necessitated means for overcoming the increase in voltage drop.

Induction-type feeder-voltage regulators have been developed to a point where they are in every way a thoroughly reliable and highly efficient type of apparatus, and have supplanted the so-called step-type regulator for practically all purposes. It has been found in a large number of cases that with present copper prices, considerably less expense is involved by installing a regulator to raise the voltage on a heavily loaded feeder, or where an extension of the line has been made, than by installing heavier feeder copper. In addition the voltage regulation throughout the entire day will be closer, when the regulator is used, than would be the case if heavier conductors were used without a regulator.

New developments were undertaken during the year to further improve the regulator from the standpoints of electrical performance and reliability of operation. These developments have resulted in a complete line of single-phase motor-operated regulators from 5.75 to 69 kilovolt-amperes. Improvements in certain details were made in the standard line of three-phase regulators, which range in size from 10 to 100 kilovolt-amperes.

Switchboards.

Probably more than any other detail line, switchboards and switchgear have been affected by the tremendously increased central-station loads incident to the prosperity of the past year. Stations which, due to industrial depression, have for the past two or three years postponed increases in capacity have suddenly found their loads growing far beyond their capacity even when standby stations more or less obsolete have been brought into operation. The net result has been not only large increases in existing stations, but the building of new stations of huge ultimate capacity whose initial equipment has run into capacities of from 40,000 to 100,000 kilovolt-amperes. Ultimate capacities of these new stations have varied from 80,000 to 240,000 kilovolt-amperes per individual station.

This, of course, has meant switchgear orders of exceedingly large value with a tremendous amount of detail equipment and, due to large ultimate station capacity contemplated, oil breakers of the highest ultimate breaking capacity available. Some of these orders have involved initial equipment including as high as 60 600-ampere and 12 2,000-ampere, 23,000-volt, oil circuit-breakers per order. Control desks and boards, involving as high as 40 sections and 60 panels have been ordered. The amount of smaller details, such as disconnecting switches, instrument transformers, meters, relays, etc., has been unusually large.

With this tremendous amount of business naturally the maximum efforts of the manufacturer have centered on aggregating apparatus and making station layouts to produce the complicated control equipment demanded by present-day ideas of size, reliability and flexibility. This has meant capitalizing and taking advantage of the time and effort expended in the previous year or two in developing and bringing our various high-powered oil breakers, switchboard accessories, etc., which it was anticipated would be required by the present degree of station expansion when it came. With 20-inch diameter, round-tank, high-speed, oil breakers capable of rupturing 625,000 kilovolt-amperes at the arc with 23,000 volts; latched disconnecting switches and busbar supports made up of strong pillar-type insulators and proper malleable-iron fittings; long-scale, open-face meters capable of standing any overloads, that current transformers can deliver, and absolutely accurate overload and reverse-power relays of the induction type, the Westinghouse company was in a particularly fortunate position to meet the demands of the sudden growth in central-station capacities, particularly as its corps of experienced switchboard engineers had been maintained for just such an emergency.

There have been a few additions to existing high-voltage transmission systems, one new 40,000-kilowatt station being built for a Montana corporation, to feed into a 110,000-volt transmission system. Two additions to a well known 140,000-volt system in Michigan were also made. Switching equipment for a 132,000-volt tie line between a western Pennsylvania power company and a steam station in West Virginia was also ordered the later part of the year.

The use of black-dial, open-face switchboard meters with white scales and pointers has also shown increasing favor, particularly with the growing tendency for the use of dull-black-finished slate for panel material.

With induction relays having a sustained accuracy which permits selective action, on actual systems where they are installed, of one-half second and even better, there has been a remarkable number of these relays used on new installations and on existing systems to which these new installations form an addition. On some systems where hundreds of these are employed trouble due to relay failures have been almost unbelievably small.

Lighting Equipment.

The Westinghouse company has endeavored to improve many of the details of its Luxsolite outdoor fixtures, and has completed a new design for these fixtures which follows closely the standard design for high-candlepower Mazda C lamps. Continued progress has been made on the development of electrodes for the metallic-flame arc lamps and carbons for carbon-flame arc lamps, all of which have resulted in improved lighting efficiencies and better operation of the lamps. The company has also extended its line of small lighting transformers for pole and manhole mounting.

Heating Apparatus.

There has been considerable development in the industrial-heating field and particularly that applying to the heating of enameling ovens used mostly for baking the enemaled parts of automobiles. There is every indication that electricity will entirely supersede gas for this process, at least where conditions will permit the process to be carried continuously.

A complete line of steel-clad heaters has been developed to meet the requirements of general industrial heating, such as for tanks and vats of various liquids, hot presses, etc., to satisfy the demands resulting from an increased knowledge of the value of electric heat for such applications, the outlook for which looks very promising.

Fan Motors.

The most important fan development of the Westinghouse Electric & Manufacturing Company is that of the 10-inch fan motor to supplement the previous line. This fan is intended for use in homes where a high-grade fan is required, but the breeze given by a 12-inch fan is not

necessary. The new fans are made in both oscillating and non-oscillating types and for all commercial voltages and frequencies.

Electrical Equipment for the Steel Industry.

The demand for an increased output of every line of steel products has been most unusual. The result has been that all existing plants have been working to their utmost capacity and many new plants are now under construction. As an indication of the increased capacity, it is stated that the shipment of ore on the Great Lakes for 1916 was about 65,000,000 tons, which is some 50 per cent greater than the amount of ore brought down the lakes during 1915.

Steam drive in steel plants is now becoming the exception rather than the rule, and during the last year more than three-fourths of the new mills contracted for will use motor drive. Comparing motor installations on main rolls for the period 1905 to 1910, the average is approximately 40,000 horsepower per year. For the period 1910 to 1915, the average is 60,000 horsepower per year, and during the last year the increase has been at the rate of approximately 200,000 horsepower per year. The requirements for the auxiliary motors have increased in the same proportion.

There has also been a decided increase in the average size of driving unit, as a large majority of new mills now being installed are of exceedingly large capacity. The Gary works of the Illinois Steel Company contracted with the Westinghouse Electric & Manufacturing Company for a 7,000-horsepower, 25-cycle motor for a 160-inch plate mill, which from the standpoint of torque requirements is equivalent to a 10,000-horsepower motor of normal requirements. The largest motor now operating has a rating of 6,500 horsepower, it also being at the Gary works.

An application which is increasing very rapidly in numbers is that of motor drive for reversing mills. The Westinghouse company has during the last year secured orders for a large number of these equipments, some of which have a maximum rating of from 15,000 to 18,000 horsepower. The company is also furnishing the largest 60-cycle motor ever built—4,200 horsepower, 220 volts for driving the bar mill of the United Steel Company, Canton, O.

According to the present indications, the demand for electric apparatus for steel mills is even greater than it has been before, and it is evident that practically all of the steel companies are convinced that they are warranted in proceeding as rapidly as possible with extensive improvements, even though they are paying from 40 to 50 per cent more on an average for apparatus.

Another point of interest in connection with steel-mill electrifications is the rapidly increasing use of central-station power. During the last year or two this has increased fully 50 per cent over the average for a five-year period previous to 1915.

Electric Furnaces.

The use of electric furnaces in this country is growing very rapidly. It might be said that during the last year the number of furnaces contracted for more than doubled the total number of units in operation previous to January, 1916. There is also a decided increase in the average capacity, this probably being double that of the average size previous to the above-mentioned period. There has been specially increased activity in regard to the application of those furnaces for making ferro-silicon and ferro-manganese products, which are extremely important in the manufacture of steel and which, owing to their scarcity during the last year or so, have increased greatly in cost.

The Westinghouse company has recently assumed the marketing of the Thury regulator, as furnished by the Turnbull firm of Welland, Ont., Canada. Formerly this regulator was imported from Switzerland, but owing to the war it has been impossible to purchase the same.

Chemical Industry.

There has been an unusual increase in the chemical business owing to the limited import during the last year. One of the processes that has attracted particular attention has been the electrolytic production of caustic chlorine, which is used for bleaching purposes by paper mills that formerly purchased powders. They find, however, that owing to increased costs, they are warranted in installing their own manufacturing plants. This has created a demand for rotary converters and other electrical equipment.

There has been a large increase in the number of by-product coke plants requiring a large number of motors for their operation. The products are numerous and highly valuable.

Such companies as the Aluminum Company of America have greatly enlarged their various plants, and in the Niagara Falls district such plants as the Niagara Electrolytic Company, Hooker Electro-Chemical Company, International Acheson Graphite and the Union Carbide Company have made extensive improvements for which Westinghouse electrical equipment has been liberally used.

Motor Drive for Textile Mills.

A decided increase in the use of electricity in the textile industry has taken place. One important order recently secured by the Westinghouse company included the motor equipment for six mills for the Thread Mills Company, located at Spray and Draper, N. C., and owned by Marshall Field & Company. These plants were formerly steam driven, but all have changed over to motor drive. Owing to the high price of cotton and general conditions abroad, undoubtedly the textile industry will enjoy very good business conditions for quite a period, and will expand and put in more plants for making up the cotton into goods.

During the past year the Westinghouse Electric & Manufacturing Company has completed the development of a new, silent, non-metallic gear material, the use of which in the manufacture and in the form of gears is covered by patents. This material is called Bakelite Micarta-D and is radically different from any other non-metallic material on the market.

It is manufactured in sheets 36 inches square, and varying from one-sixteenth to two inches thick. Gear blanks are cut from these sheets in sizes required, and are bored, key-seated and teeth are cut by the same methods and tools as would be used for metal gears.

Electricity on Shipboard.

Another development of great significance has been the building of very large steam turbines and reduction gears for marine work. A few years ago the mercantile marine was not very enthusiastic on the subject of marine turbines, but orders are now being turned away daily for marine turbines and gears because it is impossible to make the commercial deliveries required by shipbuilders. Turbines of 15,000 horsepower capacity are now being built for marine propulsion with reduction gears of equal capacity having diameters of 129 inches. These gears have proven exceptionally suitable for the most trying operating conditions.

The application of electricity for driving shipboard auxiliaries, such as winches, pumps, blowers, etc., has in the past been retarded due principally, it is probable, to increased first cost over steam-driven machines, lack of familiarity of operating seamen as compared with steam-driven equipment, and to slight additional operating ex-

penses in maintaining electrical apparatus. The additional facilities afforded by electrically driven auxiliaries in loading and unloading vessels as well as the operation of the ships themselves promise to extend this application, and during the past year several contracts have been let covering electrical apparatus for operating such auxiliaries.

As an example of the increased use of electricity for marine work, might be mentioned the contract for the equipment of the United States Battleship *Tennessee,* which was awarded to the Westinghouse Electric & Manufacturing Company. The system of propulsion to be installed differs from anything now in use by battleships. Two huge steam turbines, developing over 33,000 horsepower, will each drive an electric generator which will supply current to four 6,500-horsepower motors, each of which drives a propeller. Thus the engines and propellers are entirely independent. The turbines can be placed wherever the designer desires to locate them. The propellers are readily reversible and the entire outfit operates at higher efficiency then is possible with engines, thus providing superior maneuvering power and rapidity of action.

Electric Railway Equipment.

Last year a report of development stated "many detail improvements have been brought out during the year on the ventilation of railway motors which materially increase the continuous rating, making it possible to use 25 or 35-horsepower motors on work which formerly required 40 to 50-horsepower motors." All of these improvements have finally been incorporated in the complete line of Westinghouse railway motors and a standard motor has been ordered for stock to cover every reasonable need.

A simplified brush holder has been developed for railway motor service. The well known Westinghouse method of mounting the brush holder, which has proven so reliable, has been retained. The working parts, however, have been simplified, making it less expensive to replace such parts, and the arrangement of the brush-holder spring gives a more even and direct pressure on the brush.

The new HLD type of control is really the PK form of controlling device with the exception that it is rearranged and the complete outfit mounted in one box. The development was brought about by the necessity for the simplest possible form of control for use on low-floor cars with resultant space limitations. This control has all the advantages of the K drum type combined with rugged and efficient features which have made the HL famous.

A new car circuit-breaker, light in weight and simple in construction, to meet the needs for light-weight type K control cars has been produced. The working parts of this breaker are mounted on a base plate which can be easily removed from the box cover, facilitating repairs; in fact, an extra base with working parts can be kept on hand to make replacement and thereby make it possible to make repairs on a work-bench without any trouble.

Automobile Equipments.

The output of automobiles in this country has reached a figure which is greatly in excess of the expectations of two years ago, the maximum output of pleasure car chasses being estimated at about 1,350,000 at the end of the 1916 season.

Electric starting and lighting outfits for trucks will, within the next year or so, be as common in application as this equipment now is on pleasure cars. The Westinghouse company has been devoting much thought and attention to this phase of the matter, developing a new line of equipment for the 1917 season, and its efforts have been towards bringing about a better standardization of types of apparatus than has heretofore been the practice.

As the demand is largely for low-priced equipment, and the inherent cost of round-frame lines of design in both motors and generators is more in line with the demand, Westinghouse designs have followed this trend except in cases where the round-frame machines could not be fitted on certain types of engines.

On the so-called multi-cylinder models of pleasure cars, that is, the eight and 12-cylinder types, a number of equipments are available, and a 12-cylinder ignition unit of the vertical type is being developed. The horizontal types of ignition will be largely discarded in the future, owing to their high cost as compared with the vertical types.

The Westinghouse company is continuing the manufacture of the high-class meter of the d'Arsonval principle, with jewel bearings. It is only the high-grade car manufacturers of discernment who will pay the price for such an instrument, and therefore, a competitive instrument, known as EI, has been developed which has a high degree of accuracy.

One other development which has been made largely within the last year is the application of Micarta duck to timing gears and pinions, and for other uses on automobiles. This material operates very quietly and gives a long life when meshed with steel gears; it also has the advantage of being applicable with simple malleable-iron hubs without the use of shroud rings or other supporting side plates, such as have usually been used in fabric or rawhide gears.

The glass-tube type of fuse with metal ferrule has come into very general use, although preference should be given to the indicator cartridge type of fuse. However, space-factor and cost considerations seem to be throwing the demand to the former type. The Westinghouse company supplies both types, with suitable fuse blocks.

Electric Vehicles.

There has been a marked extension in the use of commercial electric vehicles which has been promoted quite actively by a few of the larger central stations who are coming to realize the enormous amount of profitable business there is in charging batteries. The commercial electric vehicle, compared with the present commercial gasoline car, appears to have a brighter future than that of the electric pleasure vehicle. The economies of the former have been demonstrated quite conclusively, particularly in the case of large installations. The difficulty in connection with small installations continues to be that of obtaining suitable charging and garaging facilities.

With the increased industrial activity, there has been a greatly increased demand for electric trucks and tractors in industrial plants and at freight and steamship terminals. Several of the railroads and other transportation companies have installed equipments and industrial plants are beginning to use them very generally in the distribution of materials during process of manufacture.

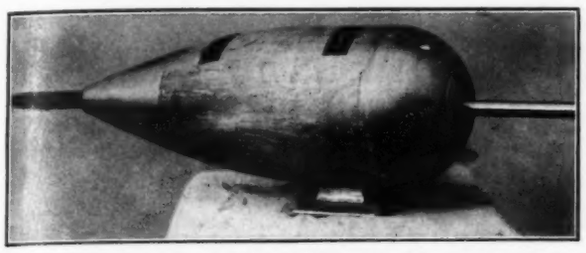
Small Motors.

In the field of motors used in the home, office, store and shop, the increased demand for electric washing machines is particularly noticeable. This is due largely to the great difficulty in obtaining household help, and the fact that an electrically driven washing machine will pay for itself in a short time in saving of help, often doing away with the laundress entirely. It is interesting to note that the principal manufacturers of washing machines have formed, for the purpose of standardization and publicity, the American Association of Washing Machine Manufacturers, with headquarters at Chicago.

There has been a very large increase in the demand for farm lighting plants, showing the general prosperity of the farmer and his efforts to modernize his home, barn and outbuildings. The extensive use of the automobile with starting and lighting equipment has undoubtedly had its effect in educating the farmer along these lines.

Compact Generator for Aeroplane Wireless Service.

Any apparatus intended for use on an aeroplane must be strong and reliable as well as light and compact. To harmonize these conflicting requirements is no easy task, but it has been done very successfully in the little generator shown in the accompanying illustration. It is really a combination of two direct-current generators mounted in a torpedo-shaped shell. One of the generators delivers low voltage for lighting the filament of the Audion wireless receiver; the other generator supplies 1,200 to 1,500 volts for wireless transmission. Both armatures are mounted on the same shaft, which is supported at each



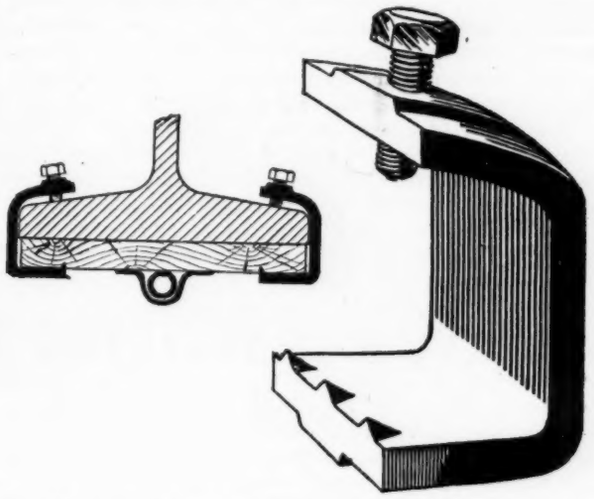
Generator of Compact, Non-Air-Retarding Construction for Aeroplane Wireless Service.

end by ball bearings. The outfit is intended to be driven by a small propeller and is to be used as energy source, for transmitting and receiving wireless telephone messages. Its weight is only about 37 pounds. It was designed and built by the Electric Specialty Company, Stamford, Conn., which builds electrical machines for special requirements.

This special machine was developed at the request of the De Forest Radio Telephone & Telegraph Company, New York City, which has recently secured a contract from the United States Navy Department for wireless equipment involving quite a number of those unique generators.

Universal Clamp for Mounting Conduits Under Girders.

To permit ready mounting of conduits under various widths and shapes of I-beams, channels, Z-bars, angle irons, etc., the firm of Simplex Conduits, Birmingham, England, has placed on the market the universal girder clip illustrated. These consist of strong malleable-iron clamps that are used in the manner shown at the left. In the case of I-beams or inverted T-



Conduit Clamp for Use on Girders—Method of Use on I-Beam Shown at Left.

bars, two clamps are used as shown. The lower edge of the clamp has three sharp teeth that grip a board, usually about three-fourths inch thick, to which the conduit straps are fastened. If channels, Z-bars or angle irons are used, two clamps are placed along the free flange near the ends of the wooden batten.

Long Life of Cedar Poles Graphically Shown

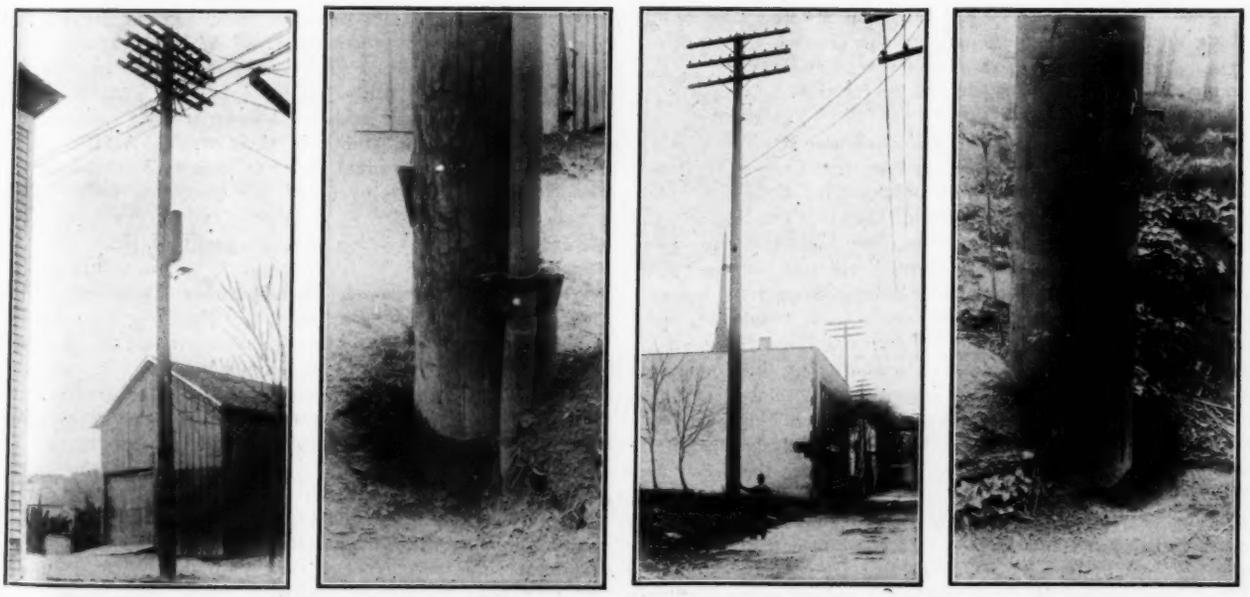


Fig. 1 Fig. 2 Fig. 3 Fig. 4

The interesting views shown above are graphic illustrations of the long life of western red cedar poles. In Fig. 1, is shown a pole of this type installed in Grand Rapids, Mich., which has been in continuous service for 17 years. It is interesting to note that there are no guy wires supporting this pole. The butt of this pole is shown in Fig. 2, it being evident that only the sap is rotted. Fig. 3 shows another Grand Rapids installation, also in service 17 years, and the butt, shown in Fig. 4, shows practically no rot. The company using these poles reports that they should be good for many more years of service.

ACTIVITIES IN THE TRADE

Mignon Wireless Corporation, Elmira, N. Y., has issued catalog No. R7, descriptive of the Mignon wireless system.

Babcock & Wilcox Company, Bayonne, N. J., manufacturer of water-tube boilers, will build a new one-story addition to its plant on Lexington Avenue, to cost about $100,000.

Wagner Electric Manufacturing Company, St. Louis, Mo., has prepared a 16-page booklet entitled "A Modern Lumber Mill; Its Electrical and Mechanical Equipment," in which is described and illustrated the equipment of the mill, the different motor applications and types of drive being shown.

K. McLennan & Company, manufacturers of "Gale's" Commutator Compound, announce that S. M. Kahn has been appointed general manager of the company. Mr. Kahn proposes to energetically push the business of the company and will institute a co-operative selling plan, which will materially benefit the jobber and dealer. The offices of the company are now located at 1751 West Thirty-fifth Street, Chicago, Ill. "Gale's" Commutator Compound has been on the market for about 30 years, and is used in every civilized portion of the globe.

Mathias Klein & Sons, 562 West Van Buren Street, Chicago, Ill., has issued its general catalog No. 17. This is an 84-page booklet and in it are listed the extensive line of tools for electricians, linemen and mechanics manufactured by the firm. These include pliers, splicing clamps, pole-climbers, cable and wire grips, pay-out reels and many kindred devices used in electrical work and pole-line construction. The catalog is profusely illustrated and list prices are given. A number of dealers' display boards showing different assortments of tools are illustrated and described.

B. F. Goodrich Company, Akron, O., has prepared a statement showing that Akron is the rubber capital of the world. The taxable value of the plant of the Goodrich company amounts to almost one-half of the total of $43,896,440 placed upon the 168 industries located in Akron and Summit County. In these 168 industries are such concerns as the Diamond Match Company and the Quaker Oats Company, giving an idea of the immensity of the Goodrich establishments. Specifically, the amount assessed against the B. F. Goodrich Company is $20,392,830, by far the largest of any single industry in the list.

Cutler-Hammer Employees Give Christmas Party.—Nearly 6,000 people, including employees of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., their relatives and friends, attended the second annual Cutler-Hammer Christmas Party held in the Milwaukee Auditorium on December 22. Toys and candy were distributed to the 1,200 children present, while the older people danced or looked on. On the afternoon of the party each employee was given a cash Christmas gift and was dismissed from work at four o'clock. The affair was in charge of the company employee's committee.

Arc Welding Machine Company, 220 West Forty-second Street, New York City, has issued a very attractively illustrated and printed book on arc welding. This explains the difference between ordinary methods of fusion welding and arc welding, pointing out how the latter can be produced and its special characteristics and advantages. The constant-potential and the constant-current systems of arc welding are compared and the latter is described in detail with the aid of many illustrations. This system, for which the equipment is manufactured by the company, was described in our issue of December 30, 1916. The special equipment for it is described in great detail in the book referred to and comparative results obtained with this system and other systems are given.

The American Conduit Manufacturing Company, Pittsburgh, Pa., has announced that at the first of the year M. B. Austin & Company, 700 Jackson Boulevard, Chicago, Ill., became its sales agent in the Chicago territory for the following products of its manufacture: "Wiremold," the new surface wiring material, and "Wireduct," the non-metallic flexible conduit. The efficient Austin service is well known to the trade, which will find that company ready and able to offer the same service in marketing "Wiremold" and "Wireduct" in the Chicago territory.

The Robbins & Myers Company, Springfield, O., has announced that in order to take care of its rapidly expanding business the company's capital stock will be increased $5,000,000, of which $2,500,000 will be preferred and $2,500,000 common stock. Of the preferred stock, $1,500,000 has been sold, and the remainder will be held in the treasury. Of the common stock, $1,250,000 has been subscribed for, and the rest will be held as treasury stock. During the past year additions to the Robbins & Myers' factory have been completed which have almost doubled the capacity of the plant.

Westinghouse Lamp Company, 165 Broadway, New York City, has issued the December number of its publication, "How I Did It," which contains stories of lamp sales written by salesmen. This issue maintains the high standard set by the three preceding issues, and contains stories by L. H. Carver, of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y.; Charles W. Loring, of the Minneapolis (Minn.) General Electric Company; H. H. Fenton, of the Marshall County Power & Light Company, Blue Rapids, Kans.; E. J. Beil, of the Youngstown & Sharon Street Railway Company, Youngstown, O., and E. C. Hay, of the Cleveland (O.) Electric Illuminating Company. Copies of the publication will be sent to those making request to the company.

Benjamin Electric Manufacturing Company Offers Bonus to Employees.—At a Christmas celebration for its employees, held at Aiken Institute, on December 24, the Benjamin Electric Manufacturing Company, of Chicago, announced that until further notice each employee of the company would be given a monthly bonus of five per cent of each month's salary, and an additional five per cent contingent upon promptness and ability in their work. At the celebration, which is an annual event at which Christmas gifts are distributed to employees of the company, Judge McKenzie Clelland and Dr. R. H. Moore delivered appropriate addresses. The celebration was in charge of E. A. Drake, factory manager.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is making an exhibit at the New York Automobile Show that possesses considerable interest to all connected in any way with the automobile industry. It contains a representative line of automobile electrical equipment and accessories made by the company, including starting motors, lighting generators, combined lighting and ignition generators, the vertical ignition unit, and a complete Ford starting-lighting-ignition outfit mounted on an engine. In addition, the company has four different types of rectifiers on exhibit, and shows a number of blank gears, sheets, rods and tubes made of Micarta; the latest types of meters for dashboard mounting and numerous accessories, including fuses, fuse blocks and cutouts are also shown. A large number of representatives of the company are in attendance at the show. The exhibit of the company at the Chicago Automobile Show will be essentially the same, except that the personnel of the representatives will be changed somewhat.

General Electric Company, Schenectady, N. Y., has planned a very striking exhibit of electrical devices to be shown at the annual Automobile Show in New York City on January 6 to 13. Among the exhibits will be the following: Several types of motor-generator sets for battery charging, both for small automobile batteries and electric-vehicle batteries; a small generator especially adapted to the Henderson motorcycle for battery-charging and lighting, complete with regulator; a steel cabinet for individual vehicle-charging sets; a four-section slate panel showing different arrangements of charge-regulating devices; a Waynelite transformer with a Ford magneto driven by a variable-speed motor equipped with speed-indicating device and lamps; welding transformer with tool for lead-burning of battery connections; an Entz magnetic transmission and control set direct-connected to a gasoline automobile engine, which will include a complete steering column assembly and a 12-cell storage battery.

Western Electric Company, 195 Broadway, New York City, has issued the 1917 edition of its "Electrical Supply Year Book." It is the third of its series of year books, the first having been issued in 1915 to supersede the company's general catalog. The last edition is a 1,324-page book, 6½ by 9½ inches in size, and contains complete information on Western Electric products for the electrical supply dealer, as well as on other manufacturers' lines of electrical supplies handled by the company. List prices are given, to which is applied a uniform discount, giving the approximate cost to the trade of any article shown. To this extent the book is a buyer's guide. This method of bringing out a year book and thus giving the latest information about supplies has grown to be quite popular with purchasers of electrical equipment, as has also the method of giving list prices with one basic discount. The book contains information of considerable use to any electrical dealer and should be a valuable adjunct to his desk.

PERSONAL AND BIOGRAPHICAL

MR. HERMAN E. EDDY, an attorney of Brattleboro, Vt., has been elected a director of the Connecticut River Power Company, succeeding MR. CLARKE C. FITTS, recently deceased.

MR. W. Y. SHAW, of the Skinner Engine Company, Philadelphia, Pa., gave an interesting address on "The Universal Unaflow Engine" before members of the Engineers' Club, Trenton, N. J., on December 22.

MR. H. O. SWOBODA, consulting engineer, of Pittsburgh, Pa., has been retained by the City Council of that city for the purpose of making a preliminary investigation of the street-lighting situation in Pittsburgh at the present time.

MR. CHARLES D. SPENCER, of Cavendish, Vt., has been chosen division superintendent of the Colonial Power & Light Company, of that city, succeeding MR. CLARENCE O. RANDALL, who resigned to accept the position of electrical superintendent of the Rutland Railway, Light & Power Company, Rutland, Vt.

MR. W. W. GRIEST, of Lancaster, Pa., MR. GEORGE BIDLACK, of New York City, and MR. JOHN M. GRAFF, of Lancaster, have been elected president, vice-president, secretary and treasurer, respectively, of the Edison Electric Company, Lancaster Gas Light & Fuel Company, and Conestoga Traction Company, of Lancaster.

MR. JAMES G. MENUT, heretofore assistant manager of the Claremont Power Company, Claremont, N. H., has been appointed manager, succeeding MR. J. D. WHITTEMORE, who has been transferred to the managership of the Reading Transit & Light Company, Lebanon, Pa., an allied corporation. Previous to beginning his service with the Claremont company, Mr. Menut was superintendent of the Colonial Light & Power Company, Springfield, Vt., for three years, during which time the business increased about 50 per cent. Mr. Menut is especially interested in the idea of a central station rendering the best possible service. The coming spring a street railway line operated by the company, will be improved by relaying of tracks, to cost about $40,000.

MR. FRED H. POSS has been appointed general sales manager of the Benjamin Electric Manufacturing Company, of Chicago, having been called from the Pacific Coast to assume his new position. Since 1905 Mr. Poss has represented the Benjamin company in the West, opening an office in San Francisco in 1905. He was at first a manufacturers' agent, representing other lines as well, but in 1912 accepted the position

F. H. Poss.

of Pacific Coast manager of the Benjamin company, which office he held until his appointment as general sales manager. Mr. Poss is a native of St. Louis, and received his education in that city. One of Mr. Poss' first duties in his new position was the calling of a sales conference for salesmen of the middle west territory. This was held at the general offices of the company in Chicago, December 27, 28 and 29, and culminated in a dinner held at the Hamilton Club on December 29, at which W. D. Steele, vice-president of the company, acted as toastmaster.

MR. RAYMOND G. METZGER, chief clerk of the Toledo (O.) Railways & Light Company, has been appointed head of the safety department of that company.

MR. D. J. MARCUS, who has been manager of Janesville (Wis.) Electric Company's office in Edgerton, Wis., during the past six years, has become manager of the Janesville Contracting Company, succeeding MR. H. E. WAGENKNECHT, who has resigned.

MR. HARRY PICKHARDT, who has been associated with the Phoenix Glass Company, of New York City, for the past eight years, has purchased the business formerly conducted by MR. L. D. HATTON, at 98 Park Place, New York City, and established himself at that address January 1 as sales agent of lighting specialties, glassware, etc. Among the firms he will represent will be the John Dunlap Company, of Carnegie, Pa., manufacturer of enameled steel reflectors. Previous to his connection with the Phoenix Glass Company Mr. Pickhardt was sales engineer for the Holophane Glass Company, of New York City, for two years and prior to that in the electrical construction business in New England. His wide acquaintance and experience in the Eastern lighting field should be of assistance and assure him success in his new work.

OBITUARY.

MR. CHAUNCEY F. MATTESON, president of the Reedy Elevator Company, and one of the pioneers in the manufacture of electrical elevators in this country, died at his home in Weehawken, N. J., December 26, after an illness lasting several months. He was 68 years old.

MR. EDWARD C. STEVENSON, of the R. W. Hunt Company, of New York City, died in Trenton, N. J., December 24. He was on an inspection trip to the plant of the John A. Roebling & Sons Company when he contracted a case of la grippe which developed into pneumonia. He was 26 years old and received his education in Wilkes-Barre, Pa. He became associated with the Hazard Manufacturing Company in that city and later with Safety Insulated Wire & Cable Company, of New York City. He entered the inspection department of the Hunt company early in 1916.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

GRAY, ME.—Distributing lines of the Cumberland County Power & Light Company have been extended to this town.

LIMERICK, ME.—The Limerick Water and Electric Company has changed its name to the Western Maine Power Company and will continue to maintain offices in this city.

BRATTLEBORO, VT.—The Twin State Gas & Electric Company will install two sample ornamental lighting standards to aid the Council in deciding what form of street lighting is desired for the village. The company has offered to install a system to replace the present incandescent lamp system in Main Street.

CAMBRIDGE, MASS.—A special committee of the City Council has reported favorably on the desirability of purchasing the plant of the Cambridge Electric Light Company and establishing a municipal plant.

FALL RIVER, MASS.—The Fall River Electric Light Company is planning to erect a transmission line over the tidewaters of Taunton Great River in this city to the town of Somerset.

LEOMINSTER, MASS.—A contract has been awarded to the J. G. White Engineering Company, of New York, by the Leominster Electric Light & Power Company for the designing and construction work in connection with the erection of a new electrical transformer substation of the outdoor type with distribution lines in the city of Leominster.

NORTHAMPTON, MASS.—The transmission line by which the Northampton Electric Lighting Company is to be supplied with energy by the Turners Falls Power & Electric Company has been placed in operation. The power station of the Easthampton Gas Company at Mt. Tom, is used as a substation. The new line will be used in emergency.

SHIRLEY, MASS.—The Massachusetts Gas and Electric Light Commission has approved an issue by the Shirley Electric Company of $27,500 additional capital stock to be issued at $50 per share.

WATERTOWN, MASS.—The City Council has made arrangements with the Edison Electric Illuminating Company of Boston for improvements to the local street-lighting system.

BRIDGEPORT, CONN.—The installation of 69 white-way units, 50 arc lamps and 60 tungsten lamps as additions to the local electric-lighting system is being considered by the City Council.

NEW HAVEN, CONN.—An increase in capital stock of $825,000 is announced by the United Illuminating Company, the proceeds to be used for plant extensions and improvements in Bridgeport and in this city.

NORWICH, CONN.—The Shore Line Electric Railway Company, of this city, is planning to issue bonds to the amount of $6,000,000 for improvements to its property. The company also plans to furnish electric service in towns along its lines and furnish power to its subsidiaries, all of which will involve extensive improvements to the present plant.

PACKER, CONN.—The stone mill here is being considered by a manufacturing concern as the site for an electric generating station.

DUNKIRK, N. Y.—The City Council has made an appropriation of $3,000 for the installation of a new electric-lighting system here.

LITTLE FALLS, N. Y.—The installation of a new street-lighting system is contemplated here.

MONTGOMERY, N. Y.—The Wallkill Valley Light and Power Company has applied to the Public Service Commission for authority to exercise an electric franchise here. The company will also furnish service to the town of Crawford.

OVID, N. Y.—The Ovid Electric Company plans to make improvements and extensions to its transmission lines which will involve practically the entire reconstruction of its system.

QUOGUE, N. Y.—Electric service will be furnished in this town by the Suffolk Light, Heat & Power Company, of Southampton, which is erecting a transmission line, a part of which will be underground.

SALAMANCA, N. Y.—Superintendent H. E. Heller of the municipal electric-lighting plant has recommended the erection of an addition to the power plant and the installation of new generating equipment, at a total cost of about $15,000.

ALLENTOWN, N. J.—The new street-lighting system along the Boulevard was placed in operation December 24. The installation comprises 600-candlepower lamps with opalescent globes on standards 15 feet high, and extends for a distance of two miles, all wires being underground. The improvement, extensions to which are now under way, represents an expenditure up to the present time of about $60,000.

JERSEY CITY, N. J.—The Boulevard Commission is considering improvements in the lighting plant used for operation of the street-lighting system on the Boulevard. Edward Cahill is president of the commission.

JERSEY CITY, N. J.—The Board of City Commissioners is planning the installation of a white-way system in Monticello Avenue, with underground conduit system for feed lines. The Public Service Electric Company will make the installation.

WASHINGTON, N. J.—Bids will soon be asked for street lighting. The present five-year contract with the Washington Electric Company expires in February.

LACKAWANNA, PA.—The Niagara & Erie Power Company has made application to the Public Service Commission for permission to construct electric plants and transmission lines in the town of Stockton. It also asked permission to install a 60,000-volt transmission line from the power company's local plant to towns along the lake shore as far as Dunkirk, the initial installation to cost about $30,000, and the ultimate development about $150,000. The company also plans to erect a transmission line from Fredonia to Cassadaga to cost about $6,000.

PHILADELPHIA, PA.—The Ferguson Carpet Company has filed plans for a brick and reinforced-concrete boiler plant addition to its factory at Wayne Junction.

PHILADELPHIA, PA.—About $500,000 will be spent by the Philadelphia Electric Company in making alterations and additions to its building at Tenth and Chestnut Streets. Plans by John T. Windrim provide for a nine-story addition and the erection of three additional stories on the corner property. The John R. Wiggins Company has the contract.

SCRANTON, PA.—The Keystone Utilities Company of this city, has made arrangements for the operation of the Hanover Light, Heat and Power Company and the Hanover, McSherrystown Street Railway Company. The former company will also operate the Gettysburg Electric Company.

SOUTH BETHLEHEM, PA.—The business men of East Third Street and Northampton Avenue have formed an association, the main object of which is to provide a fund of $15,000 for the erection of an ornamental lighting system.

CHARLESTON, W. VA.—The Northern Virginia Power Company, which has been endeavoring to institute condemnation proceedings to acquire certain rights on the Shenandoah River near its plant, won a decision in the Circuit Court here last week. The company plans to make extensive improvements, included among which will be the raising of its dam in order to secure a larger plant output.

NORTH CENTRAL STATES.

AKRON, O.—The local power plant of Northern Ohio Traction & Light Company was damaged by fire December 29, causing a loss of about $12,000.

BATAVIA, O.—Plans are being considered here for the installation of an ornamental lighting system in the business district.

TOLEDO, O.—In connection with the new plant of the Toledo Railways & Light Company a large tunnel will be constructed under the Maumee River, and will be used to contain the cables carrying the power from the proposed plant on the East Side to the West Side. The new plant will embody the best features found by six of the H. L. Doherty & Company's engineers, who inspected practically every large power plant in the United States. The M. V. Kellogg Company, of New York City, was awarded the contract for the two stacks for the new power plant, to be built of white radial brick.

YOUNGSTOWN, O.—The Bell Telephone Company plans to make local extensions and improvements costing in the neighborhood of $300,000. A large part of the work will involve both underground and overhead wiring construction.

CULLOM, ILL.—The Public Utility Commission has granted authority to the Cullom Electric Company to operate an electric-lighting plant here.

PEKIN, ILL.—Plans are being made for the installation of an ornamental lighting system here.

STILLMAN VALLEY, ILL.—The Stillman Valley Electric Company has increased its capital stock from $8,000 to $16,000.

CONNERSVILLE, IND.—The Hydro-Electric Light & Power Company has been incorporated with a capital of $750,000, the incorporators being Edgar D. Johnston, Louis R. Johnston and E. G. Meeks. They expect to spend $100,000 in making improvements to the property. Robert Cass is chief engineer of the company.

AMBERG, WIS.—An option has been secured on the Davis Falls water power site and it is reported that a hydroelectric plant will be erected to supply service in Amberg and several neighboring towns.

EAU CLAIRE, WIS.—The Wisconsin-Minnesota Power Company has purchased the holdings of the Jim Falls Power Company, which will enable the former company to double its plant capacity. Most of its generated power is sold under contract with the Northern States Power Company.

PIKE LAKE, WIS.—The City Council is considering ways and means to secure electric service here. It is possible that a transmission line will be erected to Hartford and service secured from that town.

PITTSVILLE, WIS.—Plans are being made by Chester Colt, of Poysippi, for the installation of a hydroelectric plant to furnish service here.

PLYMOUTH, WIS.—A preliminary survey for the erection of a dam across the Mullett River in this town has been begun by the Milwaukee & Fox River Railway Company, which is planning to erect a hydroelectric plant.

AKELY, MINN.—The city contemplates the installation of an electric-lighting plant.

CHISHOLM, MINN.—The Minnesota Utilities Company, of this city, has been incorporated with a capital stock of $1,000,000 to develop public utilities. The company controls waterpower sites in this city and Wausau, Wis., and has been authorized to manufacture electricity for light, heat and power, and to carry on a general manufacturing business. The incorporators are R. M. Haskett and Alex McDonald, Chisholm, and Neil Brown, Wausau. The officers are Neil Brown, president; C. C. Yawkey, Wausau, vice-president, and R. M. Haskett, secretary and treasurer.

GLENWOOD, MINN.—A new franchise has been granted to the Glenwood Electric Light, Heat & Power Company to operate an electric-lighting plant here.

GRAND RAPIDS, MINN.—The new

white-way system in Leland Avenue and Second Street was recently completed and placed in operation. Extensions of the system will probably be made this spring.

SAUK CENTER, MINN.—A bond issue of $50,000 for an electric light and power plant was approved at a recent election.

WABASHA, MINN.—The Wisconsin-Minnesota Light and Power Company, of Eau Claire, Wis., will erect a new substation here.

FAIRFIELD, IOWA.—A special election will be held January 30, at which the proposition of granting an electric franchise will be considered.

COWGILL, MO.—F. A. Strawhackett has purchased the Nelson enterprises in this city, consisting of an electric-lighting plant, garage and theater, which are operated jointly.

TOPEKA, KANS.—A proposition to abandon the local electric-lighting plant and enter into a contract with the Topeka Edison Company for supplying energy for street-lighting system is being considered by the City Commission.

GILTNER, NEB.—Fire recently destroyed the municipal electric-lighting plant, causing a loss of $5,000.

BOWMAN, N. D.—The City Council is considering the purchase of the local electric-lighting plant, owned by W. R. McKenzie.

COURTENAY, N. D.—A special election will be held to vote on a proposal to issue bonds for an electric-lighting plant.

KENSAL, N. D.—Plans are being made for the installation of an electric-lighting plant here. Anton Feckler is interested.

NAPOLEON, N. D.—The Dakota Engineering & Constructing Company, of Grand Forks, is making the installation of a new electric-lighting plant for the Napoleon Light & Power Company, recently incorporated to operate here.

SOUTH CENTRAL STATES.

CAVE CITY, KY.—The Kentucky Utilities Company, of Lexington, has purchased the electrical franchise offered by this city, and will make arrangements for maintaining 24-hour service.

ALEXANDRIA, LA.—The City Council is investigating the cost of establishing an improved street-lighting system.

NEW ORLEANS, LA.—According to plans of Commissioner Lafaye and City Electrician Oiroyd, improvements to the local electric-lighting system will make New Orleans one of the best lighted cities in the country. The preliminary plans call for the installation of about 1,800 standards, which will carry 250-candlepower units and be spaced 150 feet apart. The new lighting system is provided for in the new contract with the New Orleans Railway & Light Company. The first installation will be made in St. Charles Avenue, between Lee Circle and Carrollton Avenue, work on which has already been commenced. Later extensions will be made to cover the main streets of the business district as well as some of the principal outlying thoroughfares of the city.

BRISTOW, OKLA.—The property of the Bristow Light & Ice Company, of which J. C. Vicjers was owner, has been sold to a number of business men from Chandler, Okla. The consideration was $30,000.

CROWDER, OKLA.—Plans are being discussed here for the installation of a municipal electric-lighting plant.

KAW CITY, OKLA.—Citizens here approved at a recent election the issuance of $25,000 bonds, the money to be spent for an electric-lighting plant and waterworks system. Work on the construction of the systems will be started as soon as the bonds are approved and the contract let.

PONCA CITY, OKLA.—The city plans the installation of an additional generating unit of about 200-kilowatt capacity in the municipal plant, of which P. R. Dunston is superintendent. A high-speed engine direct-connected to the unit will also be installed.

WANETTE, OKLA.—A municipal electric-lighting plant will be installed here. Contracts for the equipment have already been made.

ARDMORE, TEX.—The Consumers Light & Power Company has been incorporated with a capital of $1,000,000 by P. E. Akern, W. D. Potter and P. C. Kings, of this city, to engage in the electric light and power business.

HOUSTON, TEX.—The directors of the Baptist Sanitarium here are planning to install an electric light and power plant. D. R. Pevoto, Smith Street and Famar Avenue, is manager.

DATES AHEAD.

American Institute of Chemical Engineers. Annual convention, New York City, January 10-13, 1917. Secretary J. C. Olson, Cooper Union, New York, N. Y.

Electrical Contractors' Association of Wisconsin. Annual meeting, Hotel Wisconsin, Milwaukee, Wis., January 15-17. Secretary, Albert Petermann, 626 Lloyd Street, Milwaukee.

Western Association of Electrical Inspectors. Annual meeting, Hotel Secor, Toledo, O., January 23-25. Secretary, W. S. Boyd, 175 West Jackson Boulevard, Chicago, Ill.

American Institute of Electrical Engineers. Mid-winter convention, New York City, February 7-9. Secretary, F. L. Hutchinson, 33 West Thirty-ninth Street, New York City.

New Mexico Electrical Association. Annual convention, Albuquerque, N. M., February 12-14. Secretary pro tem., E. A. Thiele, Roswell, N. M.

SHINER, TEX.—The city contemplates the installation of a crude-oil engine, generator and other equipment in the municipal electric-lighting plant.

WESTERN STATES.

WHITE SULPHUR SPRINGS, MONT.—P. J. Twohey purchased the local electric-lighting plant from C. H. Sherman and assumed charge on January 1. Improvements to the plant and system are contemplated.

FLAGSTAFF, ARIZ.—The Arizona Lead & Zinc Company will construct a large hydroelectric plant at Mooney Falls on Cataract Creek. The electrical energy which the proposed plant will generate will be transmitted to the mines of the company and used for operating machinery and other equipment. The company also proposes to build a large mill for the reduction of ore by the electrolytic process. The project of constructing this hydroelectric plant at Mooney Falls recalls that more than a dozen years ago a syndicate of men expended several hundred thousand dollars in attempting to bring about the utilization of these falls, as well as the Bridal Veil Falls, for generating electric power. Much of this sum was spent in making surveys and in the construction of preliminary works. It finally concluded that it was not feasible to build the plant.

JEROME, ARIZ.—Authoritative announcement is made by the Arizona Power Company that it has awarded the contract for the construction of an additional electric power station which will cost approximately $1,000,000. The proposed plant will be operated by steam and will have a capacity of 10,000 horsepower. This electrical energy will supplement that which the company is already obtaining from its hydroelectric plants at Fossil Creek on the lower Verde River. It is stated that the transmission systems of the two plants will be connected and that when the additional power of the new station is available a transmission line will be constructed to Jerome for the purpose of providing power for operating the machinery of the mines and ore mills here.

PHOENIX, ARIZ.—At a recent election the residents of the Higley section voted to form a public electrical district.

YUMA, ARIZ.—The Southern Sierras Power Company, of Riverside, Cal., plans to extend its power transmission system from El Centro to Yuma, a distance of 70 miles. The electrical energy of this line will be used to supply power and lights for public and domestic use here and for operating irrigation pumping plants in this part of the valley of the Colorado River. The cost of the line is estimated at $200,000.

WALLACE, IDAHO—The Canyon Light & Power Company, of this city, has filed articles of incorporation with a capital stock of $100,000.

BREMERTON, WASH.—The Navy Department has authorized the laying of a telephone and telegraph cable between the navy yard here and the United States signal office in Seattle.

NEWPORT, WASH.—The Northern Idaho & Montana Power Company has applied to the Commissioners of Pend Oreille County for permission to make extensions of its transmission line in the county.

SEATTLE, WASH.—Plans will be started shortly by City Architect Daniel Huntington for the buildings to house the addition to the steam plant on Lake Union. The buildings will be of concrete and cost about $50,000.

SEATTLE, WASH.—An ordinance has been passed by the City Council authorizing the issuance of $3,000,000 in bonds for the purchase of a complete hydroelectric power plant. The Board of Public Works is authorized to advertise for bids for a plant with a capacity of 13,000 kilowatts. Validity of the $3,000,000 in bonds authorized for this undertaking will be tested in court.

MYRTLE POINT, ORE.—Fred Erixon, of Salem, was low bidder at $15,970 for construction of municipal power plant at this place.

ARBUCKLE, CAL.—The Northern California Power Company has announced its intention of installing a substation here.

BAKERSFIELD, CAL.—Plans are progressing for the installation of an electrolier lighting system in the business district of the city, estimated to cost $30,000.

CHICO, CAL.—Bids for installing the new electrolier lighting system have been called for.

COLTON, CAL.—Bids have been called for by the Board of Trustees for the annual supply of watthour meters and lighting transformers.

ESCONDIDO, CAL.—Negotiations have been completed for the sale of the property of the Escondido Utilities Company to the San Diego Consolidated Gas & Electric Company.

HEMET, CAL.—Business men of Hemet and San Jacinto are urging the authorities of these cities to consider a plan for lighting San Jacinto Street, which connects the two cities. More extensive lighting of Havard and Florida Streets in Hemet is also being urged

LOS ANGELES, CAL.—The Pacific Electric Railway Company has awarded a contract to install an electric-lighting system for the elevated railway at the rear of the Main Street station to the Southern California Electric Company.

LOS ANGELES, CAL.—The City Council has notified the Postal Telegraph Cable Company that it will have to file a new petition for a franchise to erect poles and wires in the streets of the city. The new franchise will give the city right to the use of the poles for municipal wires.

LOS ANGELES, CAL.—The City Council has referred to the finance committee a resolution declaring the public necessity of submitting a $12,000,000 bond issue to voters for acquiring the distributing systems of the Southern California Edison Company and the Pacific Light & Power Corporation and carrying on the necessary additional power development work.

MERCED, CAL.—City Engineer C. R. Martin has been instructed to investigate a proposed plan whereby the city would become local distributor of electric power furnished by the San Joaquin Light & Power Corporation.

MODESTO, CAL.—The Board of Supervisors of Stanislaus County have called an election to vote on the formation of the Crows Landing lighting district.

RIVERSIDE, CAL.—The Rialto Light & Power Company has filed articles of incorporation and has applied for permission to change its principal place of business from Rialto to Riverside.

RIVERSIDE, CAL.—Active work on the consolidation of the Home telephone system with the Pacific system has begun. The Pacific system will be enlarged and many improvements and alterations have been planned which will affect both systems.

SAN FRANCISCO, CAL.—City Engineer O'Shaughnessy has asked the Supervisors to award the contract for installing the electric cables and lighting fixtures in the Twin Peaks tunnel to R. C. Storrie & Company on its bid of $11,650.

SOUTH PASADENA, CAL.—Plans are being made by the Pacific Light & Power Corporation to move its substation here to a new location outside the city limits.

SOUTH PASADENA, CAL.—The California-Arizona Construction Company has been awarded the contract for installing an ornamental lighting system on Mission Street from Fair Oaks Avenue to Meridian Avenue, on its bid of $4,895.

VISALIA, CAL.—Property owners on South Bridge Street have taken steps to install an electric lighting system similar to the one on West Main Street.

WATTS, CAL.—The Board of Trustees has ordered an ornamental electrolier lighting system installed on Rosella Avenue from Shorb to Main Street.

WHITTIER, CAL.—John L. Wilson has been awarded the contract for the installation of reinforced concrete lighting posts

and appliances on Philadelphia Street from Painter Avenue to the westerly boundary of the city.

MANILA, P. I.—The Tacloban Electric Light & Power Plant, an industrial association, has been established in the capital of Leyte province.

CANADA.

VANCOUVER, B. C.—The contract for electrical work at the new freight sheds to be erected at False Creek for the Great Northern and the Northern Pacific Railway Companies, and for the installation of an entire lighting system for the Canadian Northwest Steel Company, Ltd., has been awarded to Mundy, Rowland & Company, of this city.

PEMBROKE, ONT.—Plans are being prepared for the construction of a power house at Black River for the Pembroke Electric Light Company, estimated to cost $7,000. New equipment, including a generating unit, water wheels, etc., will be purchased.

THOROLD, ONT.—The town of Thorold contemplates the purchase of a new turbine pump and an electric motor. L. S. O'Connor is superintendent of the waterworks system.

Proposals

ELECTRIC-LIGHTING PLANT.—Bids will be received until April 1, by the City Clerk, Gibson City, Ill., for the construction of a water and electric-lighting plant.

FIELD TELEPHONES.—Bids will be received by the United States Marine Corps, Department of Supplies, 1100 Broad Street, Philadelphia, Pa., until January 8, for furnishing 100 field telephones.

SWITCHBOARDS.—Bids will be received by the Chief Signal Officer, War Department, Washington, D. C., until January 12, under proposal 896, for furnishing five power switchboards. Further information can be obtained from Charles S. Wallace, Major of the Signal Corps.

LIGHT AND POWER SYSTEM.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until January 22, for an electric light and power system for the structural shop at the navy yard, Norfolk, Va. Plans and specifications can be obtained on application to the bureau of the navy yard named. F. R. Harris, Chief of Bureau.

SIGNAL CORPS SUPPLIES.—Proposals will be received at the office of the Chief Signal Officer, War Department, Washington, D. C., until January 20, for furnishing wall telephones, desk telephones, wing bolts, metal wall stuffing boxes, iron cases, receiver cases, hook switch catches, cast-iron doors, gongs for ringer, handles and catch for doors, condenser straps, spanner wrenches, etc. For specifications and further information apply to the above-named office, referring to circular No. 895.

ELECTRICAL SUPPLIES.—Bids will be received at the Bureau of Supplies and Accounts, United States Navy Department, Washington, D. C., for furnishing supplies at the following naval stations: Schedule 562, Pensacola, Fla., two transformers. Schedule 575, Brooklyn, N. Y., 110,000 feet of telephone wire, 3,800 feet of triplex cable, and miscellaneous lighting and power wire. Schedule 578, Brooklyn, N. Y., 50 electric heaters, and 7,000 feet of single-conductor wire. Bidders desiring to submit proposals should make application to the Bureau or to the nearest navy yard purchasing office.

Incorporations

SEATTLE, WASH.—Mason Electric Company. Capital, $10,000. Incorporators: S. W. Mason and R. G. Kendrick.

BOSTON, MASS.—Central Power & Light Company. Capital, $1,000,000. Incorporators: L. B. Hardwick, E. C. W. Johnson and J. S. Sanborn.

FLEISCHMANNS, N. Y.—The Fleischmann Illuminating Company. Capital, $20,000. Incorporators: N. London, William Rosenfeld and S. London.

PROVIDENCE, R. I.—The Tarkas Company. Capital, $10,000. To manufacture machinery, appliances and electrical tools. Incorporators: K. Tarkas, H. C. Hart and P. P. Curran.

NEW YORK, N. Y.—P. Simpson, Incorporated. Capital, $5,000. Deal in electrical supplies, fixtures, etc. Incorporators: J. A. Kohn, 246 West Seventy-sixth Street; Philip and Nathan Simpson, both of 138 West 116th Street, New York City.

NEW YORK, N. Y.—Horace Keane, Incorporated. Capital, $17,000. Lighting appliances, effects, etc. Incorporators: F. E. Hebberd, A. M. Sullivan and H. M. Keane, 165 Audubon Avenue.

MILWAUKEE, WIS.—The Electric Tool & Appliance Company. Capital, $20,000. Manufacture box cutters and scientific apparatus. Incorporators: Oscar Werwath and William Baum.

ALBANY, N. Y.—Chatham Electric Motor Corporation. Capital, $10,000. To manufacture electric motors. Incorporators: A. Kislik, S. and H. Lippman, 212 North Vernon Avenue, Arverne, L. I.

DOVER, DEL.—Continental Battery Company. Capital, $125,000. To manufacture batteries. Incorporators: Herbert E. Latter, Norman P. Coffin, Wilmington, Del., and Clement M. Egner, Elkton, Md.

ROCHESTER, N. Y.—The Chemical Electric Company. Capital, $60,000. Manufacture chemical electric batteries. Incorporators: J. C. Schefler, of Rochester; H. E. Evans and H. J. Wood, of Buffalo.

NEW YORK, N. Y.—The Lustrolite Electric Company. Capital, $25,000. Electrical engineers, etc. Incorporators: J. H. Conor, 222 West Forty-second Street; A. McVicker and John Zwicki, 1451 Broadway.

MILLBROOK, N. Y.—The Bailey Non-Stall Differential Corporation. Capital, $105,000. To manufacture automobiles and operate as electrical engineers. Incorporators: A. G. Ziesk, H. S. Gould, E. Munster, 112 West Adams Street, Chicago, Ill.

ALBANY, N. Y.—Dyneto Electric Corporation. Capital, $575,000. Manufacture electric motors, etc. Incorporators: Richard L. Phillips, 2 East 128th Street; Henry B. Moore, 540 West 113th Street, New York City, and Sigmund Faust, 1219 Union Avenue, Bronx, N. Y.

Foreign Trade Opportunities

[*Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.*]

No. 23,341. ELECTRIC-LAMP SOCKETS.—A company in Switzerland is in the market for from 5,000 to 10,000 key lamp sockets having a removable porcelain ring as insulator instead of the usual brass ring with insulated mat. The purchaser will take the brass sockets without the porcelain ring insulators if impossible to supply the latter. A sample of the socket desired may be examined at the Bureau or its District Offices. (Refer to file No. 82529.) Quotations should be made f. o. b. New York. Cash will be paid against documents. Correspondence in English. Reference.

METERS.—A list of firms in Hankow, China, interested in electric meters may be obtained from the Bureau of Foreign and Domestic Commerce. Refer to File No. 82,042. Hankow has four electric-lighting companies. Their names, character of current, and supposed nationality are: Hankow Light & Power Company, alternating, British; Hankow Waterworks & Electric Light Company, direct, Chinese; Melchers & Company, alternating, German; Tai Shoh Electric Company, alternating, Japanese. Information is not available regarding the number of meters used by the first-mentioned company. The Hankow Waterworks & Electric Light Company installed about 1,700 meters and has under contemplation the installation of alternating current instead of direct. This firm would be pleased to receive information concerning meters, particularly for the new current. The meters used by this company are American and Ferranti. Melchers & Company use approximately 400 220-volt meters manufactured by Siemens-Schuckert Werke indicating in kilowatt-hours. This firm would be interested in receiving information concerning any other makes of meters, particularly from 1 to 10 amperes each. The Tai Shoh Electric Company has installed about 200 meters in the Japanese Concession, but the make is not known. The firm would be interested in receiving information concerning any other makes.

Financial Notes

During the month of November, 1916, $86,300 of the preferred stock of the Northern States Power was sold to 108 customers of the company in home territory. This makes a total of $1,101,600 par value of the company's seven-per-cent. preferred stock held by over $2,000 customer-shareholders. Of this number 599 are purchasing $160,800 on the partial payment plan.

Elmer Dover, president of the Northern Idaho and Montana Power Company, has been appointed receiver for the corporation by Judge Rudkin of the United States District Court at Spokane. The action is understood to be preparatory to a friendly reorganization whereby the capitalization will be reduced and the company equipped with funds for immediate and future extensions.

The Pacific Gas & Electric Company has applied to the California Railroad Commission for authority to issue $2,500,000 five-per-cent general and refunding mortgage bonds at not less than 90, the proceeds to be used in the acquisition of the Oro Electric Corporation and subsidiaries. Announcement of the purchase has been made and the company took over the properties on January 1.

The Illinois Public Utilities Commission has authorized the Commonwealth Edison Company to issue $4,583,900 of its capital stock to stockholders at par in the ratio of one share of the new stock for each ten shares now held. Commonwealth Edison stockholders of record January 10 may subscribe to new stock of 10 per cent of their holdings in four instalments, on February, May, August and November 1, 1917.

Consolidation of all Bell Telephone properties in Missouri, Kansas, Arkansas and Oklahoma into one corporation, with headquarters in St. Louis, has been asked for in petition filed with Missouri Public Service Commission. The proposed new company is to be known as Southwestern Bell Telephone Company. Authority was also given Missouri and Kansas Telephone Company., by the Commission to increase its capital from $20,000,000 to $50,000,000.

Spencer Trask & Company, New York City, and Baker & Watson, Buffalo, are offering an issue of refunding and improvement mortgage five-per-cent bonds of the Hydraulic Power Company of Niagara Falls. The company owns the oldest power plant now using the waters of Niagara River for power purposes. The total net income reported for the calendar year 1916, three months being estimated, available for bond interest, is equivalent to over three times the annual interest requirement on the total bonded debt.

The Public Service Corporation, Newark, N. J., operating the Public Service Electric Company, Public Service Gas Company and

CLOSING BID PRICES FOR ELECTRICAL SECURITIES IN THE LEADING EXCHANGES AS COMPARED WITH THE PREVOUS WEEK.

	Jan. 1.	Dec. 25.
American Telephone & Telegraph (New York)	123⅜	125¼
Commonwealth Edison (Chicago)	141	140⅛
Edison Electric Illuminating (Boston)	226	225
Electric Storage Battery, common (Philadelphia)	69	69
Electric Storage Battery, preferred (Philadelphia)	69	69
General Electric (New York)	167	167¾
Kings County Electric (New York)	125	125
Massachusetts Electric, common (Boston)	4¼	4½
Massachusetts Electric, preferred stamped (Boston)	27	27
National Carbon, common (Chicago)	331	330
National Carbon, preferred (Chicago)	—	—
New England Telephone (Boston)	126	124
Philadelphia Electric (Philadelphia)	33¼	33
Postal Telegraph-Cables, common (New York)	—	65
Postal Telegraph-Cables, preferred (New York)	66	—
Western Union (New York)	96½	101½
Westinghouse, common (New York) (ex-dividend)	54⅝	56
Westinghouse, preferred (New York)	—	—

Public Service Railway Company, has issued a report covering the month of November, showing a gross increase in total business for the month of $438,240, an increase of 13.1 over the corresponding month of 1915. The balance available, after payment of operating expenses, etc., is $36,150 above the same month of 1915, or a net total of $580,493. For the eleven months of the year, ending November 30, the gross increase in total business is $4,534,683, or 13.4 per cent.; the balance available, after payment of operating expenses, fixed charges, etc., is $5,148,875, allowing an increase available for dividends over the corresponding period of 1915 of $1,074,889.

The consolidated statement of earnings for November of the Republic Railway & Light Company and its subsidiaries, including the Mahoning & Shenango Railway & Light Company, based on the earning officially reported by the subsidiaries, shows gross earnings for the month of $344,942.54. The gross earnings for November, 1915, were $289,151.14, the increase, as in preceding months, being attributed to the great industrial activity with the growing use of electrical power in the big industries. Operating expenses, depreciation and taxes for the month of November, 1916, showed an increase of 17.22 per cent over those expenses in the corresponding month in 1915, being $196,083.16. Similar increases in other expenses are shown and the increase in net income was $11,281.19.

At the annual meeting of Detroit United Railway Company to be held February 6, the shareholders will be asked to approve an increase in the capital stock of the company from $12,500,000 to $25,000,000. The directors state that it will be necessary to incur obligations and expend considerable amounts of money in the acquisition and construction of additional lines of electric railway, etc., as well as in betterments and improvements, the cost of which would be properly chargeable to capital account. The directors will also ask authority to issue the new stock at such times and in such amounts as required. This means that Detroit United Railway plans to finance its future capital requirements by the sale of capital stock and as the stock is now above $125 a share this will mean profitable rights for the stockholders.

Kings County Electric Light & Power Company has notified stockholders that the board has the remaining of $2,500,000 of the $5,000,000 six-per-cent convertible debenture bonds authorized in 1912. The bonds will be dated March 1, 1913, and will have the September 1, 1917, coupon and subsequent coupons attached. They will be convertible into stock at option of the holder and mature March 1, 1925. Each share of stock will give the holder the right to subscribe to $15 of the debenture bonds. The bonds will be offered to stockholders of record January 9 at par and purchase price is payable 50 per cent on or before March 1, 1917, and 50 per cent on or before June 1, 1917. Bonds will be issued in denominations of $100 and $1,000. Warrants will be mailed to stockholders specifying the amounts of bonds which may be subscribed for. Proceeds of the bonds will be used for extending the business of the company.

Carolina Power & Light Company, controlled by the Electric Bond & Share Company, has declared an initial dividend of one-half of one per cent on its $4,350,000 common stock. The company operates in Raleigh, Durham, Goldsboro and other communities in North Carolina and also controls the Asheville Power & Light Company and the Yadkin River Power Company. The population served by the company and its subsidiaries is about 145,000. The large gain in earnings of Carolina Power & Light and its allied companies shows something of the changed conditions in the South in the last year. Gross of the operated properties is now running nearly $100,000 a year over preceding years, and its two subsidiaries also report increases. For the 12 months ended September 30, Carolina Power & Light, after deducting fixed charges and preferred dividends, showed earnings of about three per cent on its common stock and for the calendar year will show a larger rate. Electric energy is obtained from its subsidiary, the Yadkin River Power Company, which has a 32,000-horsepower hydroelectric station and an extensive transmission system, and in addition the company has ample reserve steam generating supply of 5,000 horsepower in Raleigh, with about 4,000 additional hydroelectric generating capacity. The growth in business of the two subsidiaries may be seen from the fact that in the year ended September 30, these two companies paid Carolina Power & Light $76,550 in dividends compared with $60,000 in the preceding year. The company is steadily increasing its business field, linking up other communities to its transmission and distributing lines. The electrification of the cotton mills of the section is under way and there are a number of other industries which will be supplied with electric power in a short time. Combined gross of all companies in the Carolina Power & Light system are in excess of $1,500,000 a year, and this amount is expected to be materially increased in the next year. The system has over 16,000 customers and with the addition of service to a number of other communities this will be largely increased in 1917.

Dividends.

	Term.	Rate.	Payable.
Am. Tel. & Tel.	Q	2 %	Jan. 15
Cen. & S. A. Teleg.	Q	1.5 %	Jan. 10
Cen. Ill. Pub. Serv., pf.	Q	1.5 %	Jan. 15
Cin., Newp. & Cov. St. & Trac.	Q	1.5 %	Jan. 15
Cin., Newp. & Cov. St. & Trac., pf.	Q	1.125%	Jan. 15
Cities Service	M	0.5 %	Feb. 1
Cities Service	Ex.	0.5 %	Feb. 1
Cities Service, pf.	M	0.5 %	Feb. 1
Con. T. & N. J.	—	2 %	Jan. 15
Duquesne Light, pf.	Q	1.75%	Feb. 1
Elec. Securities	Q	1.25%	Feb. 1
Manch. Tr., Lt. & Pw.	Q	2 %	Jan. 15
Mex. Teleg.	Q	2.5 %	Jan. 17
Montreal Tram.	Q	2.5 %	Feb. 1
Nat. Properties, pf.	—	3 %	Jan. 15
Niagara Falls Pw.	Q	$2.00	Jan. 15
Phila. Co.	Q	87.5c	Feb. 1
Phila. & W., pf.	Q	1.25%	Jan. 15
Rep. Ry. & Lt.	Q	1 %	Jau. 15
Rep. Ry. & St., pf.	Q	1.5 %	Jan. 15
York Rys., pf.	Q	1.25%	Jan. 30
York Rys., pf.	Ex.	2.5 %	Jan. 30

Reports of Earnings.

REPUBLIC RAILWAY & LIGHT.

	1916	1915
November gross	$ 344,943	$ 289,151
Net after taxes	148,859	121,885
Total income	149,109	122,385
Surplus after charges	76,466	65,185
Balance after preferred dividends	48,634	39,228
11 months' gross	3,614,204	2,800,428
Net after taxes	1,522,059	1,094,236
Total income	1,527,888	1,096,026
Interest and discount	773,321	618,170
Preferred dividends	288,288	285,527
Surplus	466,279	192,329

COLUMBIA GAS & ELECTRIC

	1916	1915
November gross	$ 824,324	$ 684,434
Net after taxes	394,158	308,597
Total income	446,645	356,983
Surplus after charges	100,614	21,836
11 months' gross	8,045,685	7,185,464
Net after taxes	4,021,288	3,499,882
Total income	4,527,088	3,970,669
Rentals, leases, etc.	3,131,502	3,079,502
Fixed charges Columbia Gas & Electric	635,598	627,128
Surplus	759,988	494,960

POSTAL TELEGRAPH.

Earnings of the Postal Telegraph Company of New York for October and 10 months, as compiled from Interstate Commerce Commission reports, follow:

	1916.	1915.
Total revenues	$ 208,427	$ 194,737
Operating expenses	177,757	161,512
Net revenues	30,669	33,224
Operating income	27,681	30,240
January 1 to October 31:		
Total revenues	1,691,693	1,620,035
Operating expenses	1,637,223	1,520,907
Net revenues	54,470	99,127
Operating income	20,964	59,514

GREAT WESTERN POWER.

	1916.	1915.
November gross	$ 360,074	$ 302,160
Net after taxes	253,560	197,864
Surplus after charges	100,754	98,572
Eleven months gross	3,412,134	2,726,277
Net after taxes	2,192,630	1,881,480
Surplus after charges	997,448	888,633
Twelve months gross	3,724,061	2,972,153
Net after taxes	2,394,015	2,005,781
Surplus after charges	1,099,990	973,613

Electrical Patents Issued December 26, 1916

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,209,651. **Egg Tester.** G. Adelmo and J. Mignone, Springvalley, Ill. Arrangement of electric lamp, egg carrier, etc.

1,209,652. **Carbureter.** G. A. F. Ahlberg, Pittsburgh, Pa. Has electrically heated conduit from mixing chamber.

1,209,655. **Lamp Socket.** W. F. Anklam, assignor to C. M. Hall Lamp Co., Detroit, Mich. Sheet-metal blank has projections locking the edges together when bent into a cylinder.

1,209,680. **Method of and Apparatus for Detecting the Presence of Location of Submerged Metallic Bodies.** P. B. Delany, South Orange, N. J. When submarine or other metal body approaches an electrode of a number distributed over certain area, the resistance of the circuit of that electrode is varied and indication given.

1,209,689. **Telephone System.** F. W. Dunbar, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Arrangement of link circuits.

1,209,699. **Trap Nest.** G. W. Guthrie, Emsworth, Borough, Pa. Egg closes contacts in alarm circuit.

1,209,704. **Method of and Apparatus for Electric Welding.** C. L. Hawes, assignor to American Fork & Hoe Co., Cleveland, O. Resistance type process for welding tubular articles.

1,209,710. **Wire Electrode for Electrolytic Purposes.** M. Huth, assignor to Siemens & Halske Aktiengesellschaft, Berlin, Germany. Consists of number of freely hanging wires with weights and spacers at bottom.

1,209,735. **Registering, Recording and Computing System.** G. W. Lorimer, assignor to National Cash Register Co., Dayton, O. System of cash registers operated by electrical impulses.

1,209,742. **Method of Bonding Rails.** G. A. Mead, assignor to Ohio Brass Co., Mansfield, O. Manner of securing the ends to the rails.

1,209,744. **Electric Switch.** H. J. Morey and E. E. Brogden, assignors to Pass & Seymour, Inc., Solvay, N. Y. Two-push-button snap.

1,209,762. **Lamp and Number-Plate Support for Vehicles.** E. M. Rosenbluth, Philadelphia, Pa. Structural details.

1,209,766. **Apparatus for Measuring the Maximum Values of Alternating-Current Voltages.** C. H. Sharp, White Plains, N. Y. An electric valve is connected in series with an electrostatic voltmeter.

1,209,775 and 1,209,776. **Dynamoelectric Machine.** C. W. Starker, assignor to Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. Structures of pressed-steel car motor frames of the split type.

1,209,792. **Switch.** H. W. Young, assignor to Delta Star Electric Co., Chicago, Ill. Device having arcing horns.

1,209,793. **Signal Lantern.** A. A. Ziegler, Boston, Mass. Illuminating unit having two sockets and electromagnetic, circuit-controlling means.

1,209,806. **Lamp Attachment.** H. J. Brennecke and F. Ihrcke, Chicago, Ill. Colored, transparent, conical cap attached to lamp bulb.

1,209,820. **Spark-Plug.** D. M. Dunning, Auburn, N. Y. Structural details.

1,209,825. **Telephone System.** J. Erickson, assignor to Automatic Electric Co., Chicago, Ill. Calling device; structure of dial impulse transmitter for automatic systems.

1,209,826. **Telephone System.** J. Erickson, assignor to Automatic Electric Co. Arrangement of impulse transmitter in automatic, common-battery system.

1,209,834. **Telephone-Exchange System.** C. L. Goodrum, assignor to Western Electric Co., New York, N. Y. Selective party-line system.

1,209,835. **Process of Treating Materials Electrolytically.** W. E. Greenawalt, Denver, Colo. Manipulation of anolyte and catholyte which are kept separate.

1,209,842. **Wire Connector.** O. E. Hunt, assignor to Packard Motor Car Co., Detroit, Mich. Plug and socket.

1,209,846. **Surgical Cleansing Apparatus.** C. E. Kells, New Orleans, La. Comprises intermittently driven electric vacuum pump

for inserting or removing fluids from wounds or cavities.

1,209,852. Illuminating Device for Talking-Machine Records. C. A. Kotterman, Washington, D. C. Special structure of battery flashlight adapted for mounting adjacent record.

1,209,862. Electric Heating Appliance. T. Lidberg, assignor to Chicago Surgical & Electrical Co., Chicago, Ill. Portable unit for immersion, etc., comprising indicating lamp and thermostatic controller.

1,209,871. Method of and Apparatus for Electric Welding. F. H. Neff, assignor to Electric Railway Improvement Co., Cleveland, O. For uniting bonds with rails.

1,209,892. Electrical Connector. A. J. Seeman, assignor to Loeffelholz & Co., Milwaukee, Wis. Has member readily removable from casing when it or binding screws are broken.

1,209,908, 1,209,909 and 1,209,910. Lamp Socket. C. A. Vetter, Pittsburgh, Pa. First two patents: Structural details of devices having two-part insulating bases. Third patent: Manner of securing cap to shell.

1,209,915. Pyrometer. J. W. Weitzenkorn, assignor to Gibb Instrument Co., Pittsburgh, Pa. Has electric-lighted comparison color-device.

1,209,917. Engine Starter. G. Westinghouse, Pittsburgh, Pa. Relates to driving connections between motor and engine.

1,209,932. Hand Generator. C. P. Bradley, Pemberton, N. J. Structure of magneto.

1,209,941. Fuel and Spark Controlling Mechanism. J. B. Dalbey, assignor of one-half to J. A. King, Nevada, Iowa. For operating contacts and valves.

1,209,961. Electrically Operated Typewriter. E. Hausberg, Charles City, Iowa. Arrangement of key-controlled selective magnet, relays, power magnet, etc.

1,209,962. Battery Cradle for Electric Vehicles. H. E. Heath, assignor to Lansden Co., New York, N. Y. For supporting battery beneath truck body.

1,209,969. Egg-Testers. W. Humphrey, Auburn, Neb. Details of battery and lamp circuit and contacts.

1,209,987. Automobile Headlight. G. R. Matheson and J. B. Shaw, Winnipeg, Manitoba, Canada. Has illuminated number-plate and signal mounted on top of headlight casing.

1,209,992. Dynamoelectric Machine. H. V. Nye, West Allis, Wis., assignor to Allis-Chalmers Mfg. Co. Electric fan is mounted within commutator for cooling.

1,210,001. Wire-Covering Machine. F. S. Randall, Jersey City, N. J., assignor of one-third to I. L. C. Gooding, Summit, N. J., and one-third to C. V. Yates, Jersey City, N. J. Arrangement of spools, tables, etc., of braiding machine.

1,210,017. Electrolytic Recovery or Zinc From Ores and Other Zinc Bearing Materials. U. C. Tainton, Johannesburg, Transvaal, South Africa. Continuous process.

1,210,018. Curling Iron. S. Trood, assignor to Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. Has connections with heating element permitting rotation of the parts without breaking circuit.

1,210,023. Illuminated Safety Bracket for Automobiles. C. N. Wagher, Knoxville, Ill. For carrying number-plate.

1,210,024. Auto Tail-Lamp Signal. G. F. Wakefield, San Jose, Cal. Direction indicator with special signals and operating motor.

1,210,027. Signal Lamp. L. H. Wilbur and W. F. Wilbur, Dunkirk, N. Y. Electromagnetic mechanism bringing lamps alternately into illuminating position.

1,210,029. Brush for Dynamoelectric Machines and Method of Attaching Conductors Thereto. C. B. Auel, assignor to Westinghouse Electric & Mfg. Co. Manner of securing pig-tails to carbon brushes.

1,210,033. Starting Apparatus for Internal-Combustion Engines. J. Bijur, assignor to Bijur Motor Lighting Co., Hoboken, N. J. Switch for motor is interconnected with gearing.

1,210,036. Terminal Block for Electrical Measuring Instruments. W. M. Bradshaw, assignor to Westinghouse Electric & Mfg. Co. Structure and mounting of connectors on insulating block.

1,210,039. Lamp-Glare Reducer. H. J. Brennecke, assignor of one-half to R. Malcolm, Chicago, Ill. Dimmer disk is mounted on lamp bulb.

1,210,049. Electrical Protective Device. A. W. Copley, assignor to Westinghouse Electric & Mfg. Co. Circuit-breaker is opened through wheatstone bridge arrangement when temperature of protected device is excessive.

1,210,058. Electrical Protective Device. C. L. Fortescue, assignor to Westinghouse Electric & Mfg. Co. Temperature of protected device acts on resistor of negative temperature coefficient in trip circuit of circuit-breaker.

1,210,062. Electrically Heated Culinary Apparatus. W. S. Hadaway, assignor to Westinghouse Electric & Mfg. Co. Arrangement of terminal connections.

1,210,068. Cable Terminal-Plug Retainer. E. A. Hawthorne, Bridgeport, Conn. Prevents accidental withdrawal of connecting plug.

1,210,086. Electric Water-Heater. J. C. Leitch, Los Angeles, Cal. Immersion device.

1,210,087. Adjustable Support for Electric Lamps. K. F. M. Lindblad, Everett, Mass. Articulated links for suspending lamp and permitting lateral adjustment.

1,210,094. System of Distribution. C. McL. Moss and H. A. Travers, assignors to Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa. Electric regenerative system.

1,210,110. Universal Cable-Tip. F. W. Smith, assignor of one-half to W. K. Trimble, Kansas City, Mo. Comprises a specially constructed pair of spring metal jaws.

1,210,112. Electric Prod-Pole. W. A. Smith, San Angelo, Tex. Comprises electric source and means for producing high potential for discharge into skin of animal.

1,210,146. Automobile Lamp. C. W. Canfield, Brownton, Minn. Support for hand-adjusted light-projector.

1,210,176. Duplex Receptacle. G. P. Knapp, assignor to H. Hubbell, Inc., Bridgeport, Conn. Structure of contacts, etc.

1,210,210. Automatic Train Control System. S. D. Rodgers, assignor of one-fourth to C. G. Hildreth, Pittsburgh, Pa. Track circuit controls magnets operating signal and brake-valve.

1,210,214. Sparking Indicator. H. J. Sass and O. H. Shaw, Chicago, Ill. Support has series of stationary and adjustable co-operating contacts.

1,210,215. Support for X-Ray Negative. F. L. Satterlee, Flushing, N. Y. Constructed of celluloid.

1,210,237. Feeding Mechanism for Lamp-Base Machines. T. I. Walker and J. A. Akeroyd, assignors to General Electric Co., Schenectady, N. Y. For transferring lamp bases from a hopper.

1,210,238. Feeding Mechanism for Base-Making Machines and the Like. T. I. Walker and J. A. Akeroyd, assignors to General Electric Co. Modification of above.

1,210,245. Electric-Bell Attachment. T. C. Williams, assignor of one-half to J. R. Elder, Washington, D. C. Manner of mounting and connecting unitary bell structure on support.

1,210,262. Lamp Lock-Socket. R. B. Benjamin and J. Imboden, assignors to Benjamin Eectric Mfg. Co., Chicago, Ill. Has spurs adapted to be forced into base of lamp.

1,210,263. Portable Holder for Electric Lamps. R. B. Benjamin, assignor to Benjamin Electric Mfg. Co., Chicago, Ill. Lamp is enclosed in a gas-tight chamber.

1,210,272. Headlight Shield. J. Burn, Chester, Pa. Light-obscuring element is secured over front of headlight.

1,210,283. Signaling Apparatus. C. G. Ender and G. A. Barber, Wilkinsburg, Pa. For automobiles; arrangements of switches and circuits.

1,210,290. Incandescent-Lamp Socket. G. H. Feick, Baltimore, Md. Protector for cord adjacent socket.

1,210,298. Automatic Train-Stopping Apparatus. S. Frank, New York, N. Y. Arrangement of track sections and contact rails.

1,210,314. Telephone Toll System. A. U. Hoefer, assignors to American Telephone and Telegraph Co., New York, N. Y. Arrangement of connections at central for controlling communication according to toll indications.

1,210,315. Lighting Fixture. E. E. Hoffman, assignor to Consolidated Lamp and Glass Co., Coraopolis, Pa. Manner of mounting separate shade sections.

1,210,323. Synchronizing Apparatus. L. Janssens, Brussels, Belgium. For maintaining synchronism between the motor-driven music sheet of tracker-board instrument and a motor-driven cinematograph film.

1,210,331. Thermal Circuit-Controller. F. Kuhn, Detroit, Mich. Automatic switch is controlled by fusible element.

1,210,335. Lighting System for Motor Vehicles. C. T. Lemon, Ripley, O. Control switch is associated with reversing lever.

1,210,336. Traffic Signal. J. A. McIntosh, Portland, Ore. Operating mechanism and structure of illuminated arms.

1,210,356. Circuit-Closing Device. E. Paul, New Bremen, O. Structural details of device comprising spring-pressed contacts held apart by an insulating member.

1,210,365. Lamp Attachment for Cells. M. C. Regan, U. S. Army. Lamp support and connections for attachment to terminals of dry-cell.

1,210,386. Automatic Telephone System. W. Kaisling,, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Switch construction and relay arrangement.

Reissue 14,236. Line Switch. J. N. Reynolds, assignor to Western Electric Co., New York, N. Y. For telephone circuits.

PATENTS EXPIRED.

The following United States electrical patents expired on January 2, 1917:

640,192. Electric Cloth Cutter. F. Gardner, Chicago, Ill.

640,196 Electric Meter Device. C. D. Haskins, Newton, Mass.

640,204. Trolley. C. A. Jackson, Lewiston, Me.

640,206. Milking Apparatus. D. Klein and W. P. Swartz, Poughkeepsie, N. Y.

640,258. Electric Heater. F. Bain, Chicago, Ill.

640,273. Acoustic Alarm System. C. Coleman, Chicago, Ill.

640,278. Multiple-Signal Transmitter. L. Dawson, Needham, Mass.

640,283. Electric Furnace. F. E. Hatch, Norway, Mich.

640,314. Electric Transformer. J. W. Packard and H. W. Wiswell, Warren, O.

640,316. Coin-Controlled Electrical Apparatus. J. Patterson, Chicago, Ill.

640,335. Electric Water-Filter. W. L. Teter and J. A. Heany, Philadelphia, Pa.

640,362. Incandescent-Lamp Holder. L. Canda and H. R. Bothwell, Cincinnati, O.

640,363, 640,364 and 640,365. Terminal for Electric Cables. W. L. Candee, New York, N. Y.

640,366. Electric Incandescent Lamp. F. M. F. Cazin, Hoboken, N. J.

640,371. Electric Fuse or Cutout. L. W. Downes, Providence, R. I.

640,386. Pneumatic Transfer-Tube System. S. F. Jones, New York, N. Y.

640,392 and 640,395. Gas-Engine Ignition Device. G. W. Lewis, Philadelphia, Pa.

640,404. Telephone Central-Station Apparatus and Circuits. S. G. McMeen, Chicago, Ill.

640,407. Thermostat. R. P. Osgood and J. D. Osgood, Methuen, Mass.

640,443. Coin-Operated Public Telephone Call Instrument. F. J. Clendinnen, Hawksburn and G. A. P. Weymouth, South Melbourne, Victoria.

640,465. Incandescent Lamp. E. W. Gillmer, Warren, O.

640,466. Indicator for Electric Currents Jesse Harris, Albany, N. Y.

640,479. Connector for Battery Electrodes, Fuses, Etc. W. Mills, Elizabeth, N. J.

640,492. Shade Holder for Incandescent Electric Lamps. E. A. Russell, Wallingford, Conn.

640,493. Shade Holder for Electric Lamps. E. A. Russell, Wallingford, Conn.

640,515. Art of Distributing Electrical Energy by Alternating Currents. M. I. Pupin, New York, N. Y.

640,515. Electrical Transmission by Resonance Circuits. M. I. Pupin, New York, N. Y.

640,532. Terminal for Cables. J. N. Byers, Urbana, O.

640,533. Cable Terminal. W. Callahan, Toledo, O.

640,560. Trolley. A. N. Hauver, Fitchburg, Mass.

640,565. System of Electrical Distribution. A. S. Hubbard, Belleville, N. J.

640,575. Molding or Trough for Electric Wires. H. Lee, Chicago, Ill.

640,603. Field Magnet. M. S. Towson, Cleveland, O.

640,618. Telephone-Exchange System. T. F. Ahern, Detroit, Mich.

640,625 and 640,626. Automatic Weighing Machine. W. F. Braun, Chicago, Ill.

640,688. Speed-Governor Attachment for Electrical Apparatus. J. H. McGurty, Jersey City, N. J.

640,694. Apparatus for Producing Electric Discharges. M. Otto, Neuilly-sur-Seine, France.

640,717. Electrolytic Apparatus for Extracting Precious Metals. C. P. Tatro and G. Delius, Seattle, Wash.

640,718. Process of Extracting Precious Metals. C. P. Tatro and G. Delius, Seattle, Wash.

640,727. Element for Electric Batteries. F. R. Wiley, Malden, Mass.

640,729. Electric Lamp. W. A. Fenner, Providence, R. I.